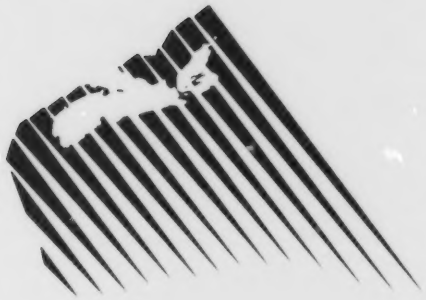


CANADA - NOVA SCOTIA
OFFSHORE PETROLEUM BOARD

COHASSET - PANUKE PROJECT

BENEFITS PLAN
DECISION REPORT

DEVELOPMENT PLAN
DECISION REPORT

91-01259/

CANADA – NOVA SCOTIA OFFSHORE PETROLEUM BOARD
6th Floor TD Centre 1791 Barrington Street Halifax Nova Scotia B3J 3K9 Tel 902-422-5588 Fax 902-422-1799

August 9, 1990

The Honourable Jake Epp
Minister of Energy, Mines and Resources
Government of Canada
580 Booth Street
Ottawa, Ontario
K1A 0E6

The Honourable Jack MacIsaac
Minister, Department of Mines and Energy
Government of Nova Scotia
1701 Hollis Street, Founders Square
Halifax, Nova Scotia
B3J 2X1

Dear Ministers:

RE: Notice of Fundamental Decision

The purpose of this letter is to give you notice of a fundamental decision made by the Board pursuant to the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act, S.C. 1988, c.28 and the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act, S.N.S. 1987, c.3.

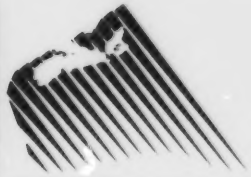
On July 17, 1990, LASMO Nova Scotia Limited applied for approval of a development plan for the Cohasset and Panuke offshore oil fields. As required by the legislation, the development plan was set out in two parts, identified as Part I and Part II. In conjunction with this application LASMO also submitted a revised Canada-Nova Scotia benefits plan, a copy of which has been previously provided to you.

At a meeting of the Board on August 8, 1990, the Board approved the Benefits Plan, Part I of the development plan and Part II of the development plan, all of which approvals are subject to certain conditions set out in the Benefits Plan Decision Report and the Development Plan Decision Report. Copies of these Decision Reports are enclosed.
Under the legislation, the approval of Part I of the development plan is a fundamental decision. If you approve of this decision, would you kindly so advise in writing so that the Board may release its Decision Report as soon as possible.

Yours truly,

Fred V. Weir
Chairman and Chief Executive Officer

Table Of Contents



Executive Summary i

Sommaire Administratif vii

Section 1
Introduction and Project Description 1

1.0 - Introduction 2
1.0.1 - Board Authority 2
1.0.2 - Regulatory Framework 2
1.0.3 - Information Considered by the Board 4

1.1 - Project Description 5

Section 2
Benefits Plan Decision Report 9

2.0 - Introduction 10

2.1 - Plan Overview 12
2.1.1 - Fabrication, Modification and Installation Activities 12
2.1.2 - Manufacturing 13
2.1.3 - Employment 13

2.2 - Fundamental Principles andStatutory Requirements 15
2.2.1 - Opportunity 15
2.2.2 - Employment 15
2.2.3 - Procurement 15
2.2.4 - Education and Training, Research and Development 16
2.2.5 - Conclusions 16

2.3 - Policies and Procedures 17
2.3.1 - Information 17
2.3.2 - Project Management 17
2.3.3 - Supplier Development 17
2.3.4 - Employment and Training, Research and Development 18

2.4 - Procurement Requirements 19
2.4.1 - Development Phase 19
2.4.2 - Production Phase 19

2.5 - Labour Requirements 20
2.5.1 - Development 20
2.5.2 - Production 20

2.6 - Consultation, Monitoring and Reporting 21

Table Of Contents

Section 3
Development Plan Decision Report 23

3.0 - Introduction 24

3.1 - Geology and Petrophysics 27

3.2 - Geophysics 28
3.2.1 - Panuke 28
3.2.2 - Cohasset 28

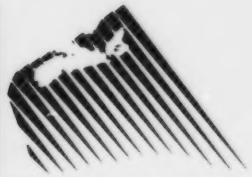
3.3 - Reserves and Recovery 29
3.3.1 - Reservoir Properties and Oil-In-Place 29
3.3.2 - Depletion Strategy 29
3.3.3 - Recoverable Reserves 30
3.3.4 - Reservoir Simulation 31
3.3.5 - Commingling 31
3.3.6 - Production/Injection Forecast 32
3.3.7 - Gas Conservation 32
3.3.8 - Produced Water Disposal 33
3.3.9 - Reservoir Management 33

3.4 - Environmental Management and Socio-Economic Impact 36
3.4.1 - Physical Environment 36
3.4.2 - Fishery Issues 37
3.4.3 - Environmental Protection 39
3.4.4 - Environmental Protection Plan 42
3.4.5 - Compliance and Effects Monitoring 42
3.4.6 - Contingency Planning 43
3.4.7 - Socio-Economic Concerns 44

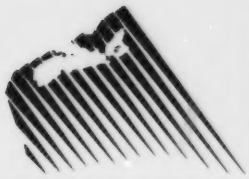
3.5 - Geotechnical 45

3.6 - Production System 46
3.6.1 - Certification Plan 46
3.6.2 - Wellhead Jackets 46
3.6.3 - Subsea Flowlines 47
3.6.4 - Production Equipment and Fluid Treatment 48
3.6.5 - Process Control, Protection and Emergency Shutdown Systems 49
3.6.6 - Lifesaving Equipment 50
3.6.7 - Firefighting Equipment 50
3.6.8 - Power Generation and Electrical System 50

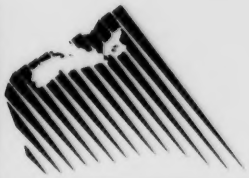
Table Of Contents



3.7	- Export System	51
3.7.1	- Tanker Mooring Study	51
3.7.2	- Tanker Operations	52
3.8	- Development Drilling and Completion	54
3.8.1	- Casing/Wellhead Design	54
3.8.2	- Drilling Fluids/Effluent Treating	54
3.8.3	- Cementing Program	55
3.8.4	- Directional Drilling/Deviation Control	55
3.8.5	- Well Control/Safety	55
3.8.6	- Completion Procedures/Artificial Lift	55
3.9	- Operations and Maintenance	56
3.9.1	- Preventative Maintenance	56
3.9.2	- Winterization	56
3.9.3	- Supply Base, Support and Construction Operations	56
3.10	- Saftey Plan	57
3.11	- Costs and Economics	58
3.11.1	- Capital Costs	58
3.11.2	- Operating Costs	58
3.11.3	- Economics	58
3.12	- Abandonment	59
Appendix A	- Glossary	60
Appendix B	- Ellis Commission Recommendations	62



Executive Summary



A Development Plan for the Cohasset/Panuke Project was submitted to the Board by LASMO Nova Scotia Limited, for approval, on behalf of themselves and their partner, Nova Scotia Resources (Ventures) Limited. Each has a 50% interest in the proposed project. This Plan was supported by a Canada-Nova Scotia Benefits Plan also submitted by LASMO. The following report gives the Board's decision with respect to these plans.

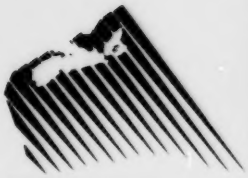
The project will involve the recovery of 5,550,000 cubic meters of light oil from the Cohasset and Panuke fields, representing 36% of oil-in-place. Production is to occur seasonally over a period of six years starting in 1992. Facilities will include steel wellhead jackets at each field, connected with a subsea flowline. Production equipment will be located on a leased jackup drilling rig adjacent to the Cohasset wellhead jacket. Produced oil will be transferred to a storage tanker moored to a buoy nearby via another subsea flowline. Shuttle tankers will periodically offload crude oil from the storage tanker for transportation to market destinations. The tankers will also be leased.

The Board found the Benefits Plan to be generally acceptable. The project is not large by offshore standards. Much of the leased equipment is not available in Canada or Nova Scotia. However, some opportunities exist for Canadian companies to fabricate wellhead jackets and production facilities, supply materials and equipment, and to make modifications as necessary to leased equipment. LASMO has committed to provide Canadian and Nova Scotian companies with the opportunity to compete competitively for this work. The Board will review all major contracts over $250,000 both at the bidding stage and prior to contract award. Employment opportunities to be created are significant, and can likely be filled by existing Canadian and Nova Scotian expertise without substantial training requirements. No significant impact on social infrastructure is anticipated.

The Board also found the Development Plan to be generally acceptable. The concept of a minimal cost development was considered appropriate in light of the small size of the reserves in comparison to other offshore developments. The Board feels that the suggested reserves may be optimistic, but that the project proposed is resilient enough to survive if recoveries are less than anticipated, and that the development concept is still valid. The Board feels careful data gathering and reservoir management will be vital to project success, and has imposed conditions on the approval to ensure that this takes place.

The Board found that the project does not pose a major hazard to the environment or fishery in the project area as long as proper procedures are put in place and are followed. This view was confirmed through the public review conducted by the Ellis Commission. Some concern was raised around the discharge of produced water into the sea. Although the Board feels that LASMO is capable of meeting existing guidelines, the Board has requested that LASMO conduct further study on the feasibility of re-injecting this water. The Board has also placed conditions on the approval to ensure that proper safety procedures and contingency plans are in place and that properly qualified people are employed on the project.

The Board is satisfied that the Cohasset/Panuke Project can proceed in a safe, environmentally sound manner, and that the proposed Development Plan will result in efficient conservation of reserves.



Executive Summary

It is a decision of the Canada - Nova Scotia Offshore Petroleum Board that the Cohasset/ Panuke Benefits Plan is approved subject to the following conditions:

Condition 1 :

The Proponent shall investigate and pursue all reasonable opportunities to provide for maximum Canadian and, in particular, Nova Scotian participation in the fabrication and assembly of the wellhead jackets, production facilities and rig modifications and modifications, if required, in the equipment comprising the Export System, and satisfy the Board that the Proponent's packaging of these contracts, their specifications and terms and conditions (including delivery times) has not disadvantaged Nova Scotian and Canadian bidders.

Condition 2 :

The Proponent shall make use of Nova Scotian and Canadian training facilities where available and competitive.

Condition 3 :

The Proponent shall provide advance notice to, and consult with, the Board at the prequalification stage of all contracts and shall submit bidders lists for all contracts for Board review. The Proponent shall provide advance notice to, and consult with, the Board at the contract award stage of the procurement process for contracts and/or purchase orders having a value in excess of $250,000. The time required for review of these materials will be determined by the Board in consultation with the Proponent.

Condition 4 :

The Proponent shall submit, by October 31, 1990 estimates of Nova Scotian, Canadian and foreign expenditures for both capital and operating costs, broken down into major components, for both the development and production phases of the Project. The Proponent shall submit, 30 days prior to the beginning of each new calendar year, detailed estimates of its annual requirements for goods and services to support production operations. These are to include projections of quantities, values, and the timing of its requirements, as well as probable sources, together with an assessment of the capability of Nova Scotian and Canadian industry to meet these requirements.

Condition 5 :

The Proponent shall provide, by October 31, 1990, estimates of the annual requirements for labour by skill classification in accordance with the Canadian Classification and Dictionary of Occupations, and the proportion that can be filled by Nova Scotians and Canadians, for each major component in both the development and production phases of the Project. The Proponent shall submit Succession Plans for positions not initially filled by Nova Scotians and Canadians.

Executive Summary

It is a decision of the Canada - Nova Scotia Offshore Petroleum Board that the Cohasset/ Panuke Development Plan Part I and Part II is approved, subject to the following conditions:

Condition 1:

Until specific regulations are promulgated for offshore Nova Scotia, the Applicant shall comply with the provisions of all pertinent regulations, including but not limited to the following regulations or draft regulations as if they were in force with respect to the offshore region of Nova Scotia.

Canada Oil and Gas Installations Regulations
(Oct. 12, 1989, DRAFT)

Canada Oil and Gas Production and Conservation Regulations

Canada Oil and Gas Occupational Safety and Health Regulations

Canada Oil and Gas Diving Regulations

Canada Oil and Gas Drilling Regulations

Canada Oil and Gas Certificate of Fitness Regulations
(March 21, 1990, DRAFT)

Canada Oil and Gas Operations Regulations

Canada Oil and Gas Spills and Debris Liability Regulations

Prior to the issuance of a Production Operations Authorization, the Applicant shall provide the Board with the following:
- a declaration which states the installation and equipment used in the development are fit for the intended use, the operating procedures are appropriate and the employees are competent and qualified to operate the installation and equipment;
- a certificate, issued by an approved Certifying Authority, that verifies that the installation and equipment are fit for the intended use and comply with all applicable regulations.

Condition 2:

Prior to injection of seawater into either the Panuke or Cohasset reservoirs, the Applicant shall conduct sufficient tests to determine the degree of pressure support from the aquifer. This condition does not apply to re-injection of produced water.

Condition 3:

Produced gas shall be used as fuel to produce electrical power needed for all new production equipment. The Applicant shall investigate ways to mitigate equipment compatibility problems to enable existing drilling rig electrical requirements to be supplied by produced gas fired generation during the production season.

CONDITION 4:

The Applicant shall submit a detailed metering schematic and proration procedure showing all metering points to be used in calculation of well and field production, including procedures for determining accurate water cuts. The Applicant shall also submit an analysis of the metering system accuracy and the resulting well test frequency required, using the procedures set out in the regulations.

CONDITION 5:

The Applicant shall submit to the Board a detailed Reservoir Management Plan prior to January 1, 1991. The plan shall be prepared using all available technical data or interpretations as well as the reservoir simulation update currently underway. The Plan shall be updated on a regular basis as the Project proceeds. The Plan shall:

- describe the updated reservoir simulation model, including the reservoir description used and the results of the latest simulation runs on which the depletion strategy is based;
- reassess the completion schedule submitted in the development plan in an attempt to increase the number of wellbores used to deplete each sand, and the time taken to produce each sand;
- indicate the frequency at which the Applicant intends to update the reservoir simulation model as the project progresses;
- address the depletion strategy for Cohasset sands 0 and 1;
- provide a revised injection schedule designed to maintain a Voidage Replacement Ratio between 0.9 and 1.1 for each sand;
- address the economic and technical feasibility of secondary and enhanced recovery;
- include specific plans to monitor for injected water breakthough.

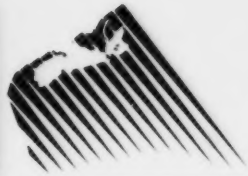
The plan shall be prepared assuming that all sands are produced with segregation in the wellbore, unless specific approval of the Board is obtained.

CONDITION 6:

Prior to the issuance of a Production Operations Authorization, the Applicant shall submit to the Board, for approval, a plan for promoting compliance with the provisions of the safety zone. It shall include ways and means for communicating the elements of the plan to the captains of fishing vessels and supply boats and for notifying the fishing industry of project related vessel traffic. This plan shall reflect the input of the fishing community.

CONDITION 7:

Prior to conducting any project related offshore activities, the Applicant shall submit to the Board, for approval, a plan to compensate fishermen for attributable damage arising from the activities of third parties as well as its own activities. This plan shall reflect the input of the fishing community and it shall outline an approach to effectively communicate its provisions to that community.



CONDITION 8:

Prior to the issuance of a Prodcution Operations Authorization, the Applicant shall further investigate the feasibility of injecting produced water into the reservoir structures. This investigation shall include the feasibility of injecting all produced water into the Panuke reservoir during the production season, and making up voidage in the Cohasset field using seawater injected during the winter shut-in period. If a viable option is not found, the Applicant must provide the Board with appropriate documentation for its consideration. Where subsurface injection is not possible, the Applicant must either adopt treatment systems capable of achievieng 25 mg/L, as described in Environmental Code of Practice, or provide the Board with evidence supporting the position that this level cannot be achieved.

CONDITION 9:

Prior to the issuance of a Production Operations Authorization, the Applicant shall submit to the Board for approval a plan which identifies the environmental limits and the procedures for oil transfers between the platform, the storage tanker, and the shuttle tanker.

CONDITION 10:

During development and production, the Applicant shall monitor the location and status of, and demonstrate the availability of, drilling units capable of expeditious deployment for drilling a relief well in the event of loss of well control at the Cohasset and Panuke fields. The results of this monitoring shall be reported to the Board on a weekly basis.

CONDITION 11:

The Applicant shall submit to the Board for approval, prior to flowline installation, details of the proposed method to protect subsea cables from damage during installation and operation of a subsea flowline crossing over the cable and shall show that the cable owner's permission has been obtained for the crossing.

CONDITION 12:

There shall be a minimum of 2200 meters, or three times the tandem passive mooring length, whichever is greater, clear distance between the CALM buoy and the nearest platform associated with the production installation. There shall be no mooring of either the storage or shuttle tanker when either vessel would be required to enter that sector of the weathervaning circle defined by an angle of 22.5° on either side of a line drawn between the production installation and the CALM buoy. Unmooring of either tanker when the vessel is lying in this sector shall proceed only when required by environmental conditions and only if the tanker proposing to unmoor is assisted by a vessel with tug capability.

CONDITION 13:

Prior to issuance of a Production Operations Authorization, the Applicant shall establish procedures acceptable to the Board to effectively preclude the operations of tankers under its control from the tanker exclusion zone. Tanker movements to and from the Cohasset/Panuke Site normally shall be via the designated approach channel. The tanker exclusion zone boundaries shall be set so as to adequately protect the area known as "The Gully."

CONDITION 14:

Both tankers shall be fitted with segregated ballast tanks, protectively located, as required by Marpol '78, Annex 1.

CONDITION 15:

Both tankers shall be fitted with appropriate means to ensure station keeping in periods of dead calm and to reduce mooring loads during periods of severe weather conditions.

CONDITION 16:

The Applicant shall use water based drilling muds for all normal operations. Where circumstances require the addition of oil to the water based drilling fluid, the Applicant shall use only products approved by the Board as having low toxicity ratings. Oil-based muds shall be used in special circumstances only and shall contain only materials approved by the Board as having low toxicity ratings.

CONDITION 17:

No winter production operations shall be conducted in the first year of operation. Any winter production operations for subsequent years are subject to Board approval.

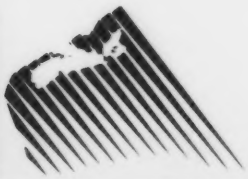
CONDITION 18:

All foreign flag vessels used to support construction, installation, drilling or production activities shall obtain a Non-Canadian Ships Safety Order prior to undertaking project related activities.

CONDITION 19:

Prior to production start up, the Applicant shall establish a plan, suitable to the Board to ensure that sufficient funds are provided for proper abandonment of the installation after production ceases.

SOMMAIRE ADMINISTRATIF



Un Plan d'exploitation pour le Projet Cohasset/Panuke a été soumis à l'approbation de l'Office par LASMO Nova Scotia Limitée, de leur part et de la part de leur associé, Nova Scotia Resources (Ventures) Limitée. Ils ont chacun un intérêt de 50 % dans le projet proposé. Ce plan a été appuyé par un Plan des avantages Canada/Nouvelle-Écosse également soumis par LASMO. Le rapport qui suit présente la décision de l'Office en ce qui concerne ces plans.

Le projet va impliquer l'extraction de 5 550 000 m tres cubes de pétrole léger des gisements de Cohasset et Panuke, ce qui représente 36 % du pétrole en place. La production doit s'effectuer sur une base saisonnière sur une période de six ans à dater de 1992. Le matériel sera constitué de treillis de tête de puits en acier dans chaque gisement, connectés à une conduite immergée. Le matériel de production sera situé sur une plate-forme de forage auto-élévatrice louée à bail située à proximité du treillis de tête de puits de Cohasset. Le pétrole produit sera transféré à un pétrolier de stockage amarré à une bouée proche par l'intermédiaire d'une autre conduite immergée. Des pétroliers faisant la navette déchargeront périodiquement le pétrole brut du pétrolier de stockage pour le transporter vers les destinations du marché. Les pétroliers seront également loués à bail.

L'Office a conclu que le Plan des avantages était dans l'ensemble acceptable. Ce projet est modeste dans le cadre des normes d'exploitation sous-marine. La plupart du matériel de location n'est pas disponible au Canada ou en Nouvelle-Écosse. Néanmoins, les compagnies canadiennes auront la possibilité de fabriquer des treillis de tête de puits et des installations de production, de fournir les matériaux et le matériel et d'effectuer des modifications sur le matériel de location si besoin est. LASMO s'est engagé à donner aux compagnies du Canada et de la Nouvelle-Écosse l'occasion d'être des concurrents compétitifs pour ce travail. L'Office va examiner tous les contrats principaux supérieurs à 250 000 $ à la fois lors de la phase d'appel d'offres et avant l'attribution du contrat. Les possibilités de création d'emplois sont importantes et ces emplois pourront probablement être pourvus par une main d'oeuvre experte disponible de Canadiens et de Néo-Écossais sans créer de besoins de formation substantiels. Nous n'anticipons pas d'impact significatif sur l'infrastructure sociale.

L'Office a également considéré que le Plan d'exploitation était acceptable dans son ensemble. Le concept d'un projet à coût réduit a été considéré adéquat vu la petite taille des réserves en comparaison avec d'autres projets d'exploitation sous-marine. L'Office pense que les réserves suggérées sont peut-être optimistes, mais le projet proposé est suffisamment flexible pour survivre au cas où les quantités extraites seraient inférieures à celles prévues et que le concept du projet reste valable. L'Office pense qu'une collection soigneuse des données et qu'une gestion du réservoir seront essentielles à la réussite du projet et il a imposé des conditions à son approbation pour assurer que cela soit effectué.

L'Office a conclu que le projet ne posait pas de risques majeurs pour l'environnement et les pêcheries de la région du projet tant que des procédures adéquates étaient mises en place et suivies. Ce point de vue a été confirmé par une enquête auprès du public menée par La Commission Ellis. Certaines préoccupations ont été soulevées en ce qui concerne la décharge d'eau produite dans la mer. Bien que l'Office considère que LASMO soit en mesure de se conformer aux directives en vigueur, il a exigé que LASMO effectue des études supplémentaires sur la possibilité de réinjecter cette eau. L'Office a aussi posé des conditions à son approbation pour assurer que des procédures de sécurité et des plans d'urgence adéquats soient mis en place et que des personnes convenablement qualifiées soient employées pour ce projet.

L'Office est convaincu que le Projet Cohasset/Panuke peut se poursuivre d'une manière sécuritaire, sans danger pour l'environnement et que le Plan d'exploitation proposé permettra une conservation efficace des réserves.

SOMMAIRE ADMINISTRATIF

L'Office Canada-Nouvelle-Écosse des hydrocarbures extracôtiers a pris la décision d'approuver le Plan des avantages Cohasset/Panuke sous réserve des conditions suivantes :

CONDITION 1 :

Le promoteur devra rechercher et profiter de toutes les occasions raisonnables de permettre une participation maximum du Canada et en particulier de la Nouvelle-Écosse dans la fabrication et l'assemblage des treillis de tête de puits, des installations de production et des modifications de la plate-forme et, si besoin est, des modifications du matériel inclus dans le système Export et il devra assurer l'Office que la manière dont le promoteur a formulé ces contrats, leurs spécifications et leurs modalités (y compris les dates de livraison) n'a pas désavantagé les soumissionnaires néo-écossais et canadiens.

CONDITION 2 :

Le promoteur devra utiliser les ressources de formation néo-écossaises et canadiennes lorsqu'elles sont disponibles et compétitives.

CONDITION 3 :

Le promoteur devra notifier l'Office à l'avance et la consulter lors de la phase pré-qualificatoire de tous les contrats et il devra soumettre à l'Office pour examen des listes de soumissionnaires pour tous les contrats. Le promoteur devra notifier l'Office à l'avance et la consulter lors de la phase d'attribution des contrats du processus d'approvisionnement pour tous les contrats et/ou bons de commande d'un montant supérieur à 250 000 $. Le temps nécessaire à l'examen de ces documents sera déterminé par l'Office en consultation avec le promoteur.

CONDITION 4 :

Le promoteur devra soumettre, avant le 31 octobre 1990, le budget des dépenses pour la Nouvelle-Écosse, le Canada et l'étranger en ce qui concerne à la fois les coûts en capital et les coûts d'exploitation, décomposés entre les principales composantes du projet, pour les phases d'aménagement et de production du projet. Le promoteur devra soumettre, 30 jours avant le début de chaque année civile, des estimations détaillées de ses besoins annuels en produits et en services nécessaires aux activités de production. Ces estimations devront inclure des prévisions concernant les quantités, les montants et les dates de ses besoins, ainsi que les sources probables, accompagnées d'une évaluation de la capacité de l'industrie néo-écossaise et canadienne à satisfaire ces besoins.

CONDITION 5 :

Le promoteur devra fournir, avant le 31 octobre 1990, des estimations concernant les besoins annuels en main d'oeuvre par classification professionnelle conformément à la Classification canadienne descriptive des professions ainsi que la proportion qui pourra être pourvue par des Néo-Écossais et des Canadiens, pour chaque composante principale des phases d'aménagement et de production de ce Projet. Le promoteur devra soumettre des Plans de succession pour les postes qui ne seront pas initialement pourvus par des Néo-Écossais et des Canadiens.

Sommaire Administratif

L'Office Canada-Nouvelle-Écosse des hydrocarbures extracôtiers a pris la décision d'approuver le Plan d'exploitation Cohasset/Panuke, partie I et II, sous réserve des conditions suivantes :

Condition 1 :

Jusqu'à ce que des règlements spécifiques soient promulgués concernant la région au large de la Nouvelle-Écosse, le soumissionnaire devra se conformer aux clauses de tous les règlements appropriés, y compris les règlements suivants ou les ébauches de règlements, mais non limité à ceux-ci, comme s'ils étaient en vigueur en ce qui concerne la région au large de la Nouvelle-Écosse.

Règlement sur les installations de pétrole et de gaz du Canada (12 oct. 1989, ÉBAUCHE)

Règlement sur le production et la rationalisation de l'exploitation du pétrole et du gaz au Canada

Règlement sur l'hygiène et la sécurité professionnelle pour le pétrole et le gaz du Canada

Règlement sur les opérations de plongées liées aux activités pétrolières et gazières au Canada

Règlement concernant le forage des puits de pétrole et de gaz naturel au Canada

Règlement sur les certificats de conformité du Canada (21 mars 1990, ÉBAUCHE)

Règlement sur les opérations sur le pétrole et le gaz

Règlement sur la responsabilité en matière d'écoulement ou des débris relatifs au pétrole et au gaz

Avant que ne soit donné le permis d'exploitation, le soumissionnaire devra fournir à l'Office les documents suivants :
- une déclaration indiquant que les installations et le matériel utilisés dans ce projet sont adaptés à l'usage prévu, que les procédures d'exploitation sont appropriées et que les employés sont compétents et qualifiés pour opérer ces installations et ce matériel;
- un certificat, émis par une autorité de certification reconnue, confirmant que les installations et le matériel sont adaptés à l'usage prévu et qu'ils sont conformes à tous les règlements en vigueur.

Condition 2:

Avant l'injection d'eau de mer dans les réservoirs de Panuke ainsi que de Cohasset, le soumissionnaire devra effectuer suffisamment de tests pour déterminer la pression pouvant être supportée par la nappe aquifère. Cette condition ne concerne pas la réinjection d'eau produite.

Condition 3:

Le gaz produit devra être utilisé comme combustible pour la production de l'énergie électrique nécessaire à tout le nouveau matériel de production. Le soumissionnaire devra rechercher les moyens de réduire les problèmes de compatibilité de matériel afin d'être en mesure de satisfaire les besoins existants en électricité des plate-formes de forage en produisant de l'électricité par brûlage de gaz durant la saison de production.

CONDITION 4:

Le soumissionnaire devra soumettre une procédure détaillée de mesure et de proration indiquant tous les points de mesure à utiliser dans le calcul de la production des puits et des gisements, y compris les procédures pour déterminer exactement les coupures d'eau. Le soumissionnaire devra également soumettre une analyse de l'exactitude du système de mesure et de la fréquence nécessaire des tests de puits, en utilisant les procédures établies dans les règlements.

CONDITION 5:

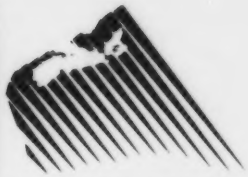
Le soumissionnaire devra soumettre à l'Office un Plan de gestion détaillé du réservoir avant le 1er janvier 1991. Ce plan devra être préparé à partir de toutes les données ou interprétations techniques disponibles réunies au cours du projet ainsi que de la mise à jour de la simulation du réservoir actuellement en cours. Le plan devra être régulièrement mis à jour au cours de la poursuite du projet. Le plan devra :

- décrire le modèle mis à jour de simulation du réservoir, y compris la description du réservoir utilisé et les résultats des plus récentes tentatives de simulation sur lesquelles est basée la stratégie d'épuisement;
- réévaluer le calendrier de réalisation soumis dans le Plan d'exploitation dans le but d'accroître le nombre des puits de forage utilisés pour épuiser chaque sable, et le temps nécessaire pour produire chaque sable;
- indiquer la fréquence à laquelle le soumissionnaire propose de mettre à jour le modèle de simulation du réservoir en cours de projet;
- aborder la stratégie d'épuisement pour les sables de Cohasset 0 et 1;
- fournir un calendrier d'injection révisé destiné à maintenir un taux de remplissage des vides entre 0,9 et 1,1 pour chaque sable;
- envisager la viabilité économique et technique d'une récupération secondaire et améliorée;
- inclure des plans spécifiques pour vérifier la percée de l'eau injectée.

Le plan devra être préparé dans l'hypothose que tous les sables sont produits avec ségrégation dans le puits de forage, sous réserve de l'obtention d'un accord spécifique de l'Office.

CONDITION 6:

Avant que ne soit donné le permis d'exploitation, le soumissionnaire devra soumettre à l'approbation de l'Office un plan destiné à encourager la conformité avec les clauses de la zone de sécurité. Il devra inclure les méthodes et les moyens pour communiquer les éléments du plan aux capitaines des bateaux de pêche et des navires ravitailleurs et pour aviser l'industrie de la pêche du traffic maritime en liaison avec le projet. Ce plan devra refléter la participation de la communauté de la pêche.



CONDITION 7:

Avant d'entreprendre des activités au large en liaison avec le projet, le soumissionnaire devra soumettre à l'approbation de l'Office, un plan de dédommagement des pêcheurs en cas de dommages attribuables causés par les activités de tierces personnes ainsi que par ses propres activités. Ce plan devra refléter la participation de la communauté de la pêche et il devra proposer une approche susceptible de communiquer ses clauses de manière efficace à cette communauté.

CONDITION 8:

Avant que ne soit donné le permis d'exploitation, le soumissionnaire devra effectuer des recherches supplémentaires concernant la possibilité d'injecter l'eau produite dans les structures du réservoir. Ces recherches devraient envisager la possibilité d'injecter toute l'eau produite dans le réservoir Panuke pendant la saison de production et de créer le vide dans le gisement Cohasset en utilisant l'eau de mer injectée pendant la période de clôture hivernale. Si une option viable n'est pas trouvée, le soumissionnaire devra soumettre à l'Office pour examen les documents appropriés. Lorsque l'injection immergée n'est pas possible, le soumissionnaire devra alors adopter des systèmes de traitement capables d'atteindre 25 mg/L, comme indiqué dans le Code de pratiques environnementales ou fournir à l'Office des preuves à l'appui de l'opinion que ce niveau ne peut pas être atteint.

CONDITION 9:

Avant que ne soit donné le permis d'exploitation, le soumissionnaire devra soumettre à l'approbation de l'Office un plan identifiant les limites environnementales et les procédures de transport du pétrole entre la plate-forme, le pétrolier de stockage et le pétrolier faisant la navette.

CONDITION 10:

Durant l'aménagement et la production, le soumissionnaire devra contrôler l'emplacement et la condition des unités de forage susceptibles d'un déploiement rapide pour forer un puits de secours dans l'éventualité d'une perte de contrôle du puits sur les gisements de Cohasset et de Panuke et il devra démontrer que celles-ci sont disponibles. Les résultats de ce contrôle seront communiqués à l'Office sur une base hebdomadaire.

CONDITION 11:

Le soumissionnaire devra soumettre à l'approbation de l'Office, avant l'installation de la conduite, des détails concernant la méthode proposée pour éviter d'endommager les câbles sous-marins lors de l'installation et de l'opération d'une conduite passant par-dessus le câble et il devra prouver que la permission du propriétaire du câble a été obtenue pour la traversée.

CONDITION 12:

Il devra y avoir un minimum de 2200 mètres, ou trois fois la longueur du système d'amarrage passif en tandem, à savoir ce qui est le plus long, de distance dégagée entre la bouée d'amarrage caténaire et la plate-forme la plus proche associée à l'installation de production. Le pétrolier de stockage ou le pétrolier faisant la navette ne devront pas être amarrés lorsque l'un de ces navires devra pénétrer dans la zone du cercle d'évitage défini par un angle de 22,5° de chaque côté d'une ligne allant de l'installation de production à la bouée d'amarrage caténaire. Le désamarrage des pétroliers lorsqu'ils se trouvent dans cette zone ne devra s'effectuer que si les conditions environnementales l'exigent et si le pétrolier qui s'apprête à désamarrer est assisté par un bateau capable de le remorquer.

CONDITION 13:

Avant que ne soit donné le permis d'exploitation, le soumissionnaire devra établir des procédures acceptables par l'Office en vue d'interdire l'activité des pétroliers qui sont sous son contrôle dans la zone d'exclusion des pétroliers. Les mouvements de pétroliers en arrivage et en partance du site Cohasset/Panuke devront normalement se faire par l'intermédiaire du chenal d'approche désigné. Les limites de la zone d'exclusion des pétroliers seront établies de manière à protéger adéquatement la zone appelée "The Gully."

CONDITION 14:

Les deux pétroliers seront équipés de réservoirs de ballast séparés, situés dans des zones protégées, comme l'exige Marpol '78, Annexe 1.

CONDITION 15:

Les deux pétroliers seront équipés de moyens appropriés pour assurer le maintien de leur position en période de calme plat et pour réduire les charges d'amarrage en période de conditions atmosphériques difficiles.

CONDITION 16:

Le soumissionnaire devra utiliser des boues de forage à base d'eau pour toutes les opérations ordinaires. Lorsque les circonstances nécessitent l'addition de pétrole au liquide de forage à base d'eau, le soumissionnaire devra utiliser uniquement des produits approuvés par l'Office pour leur faible taux de toxicité. Les boues à base de pétrole devront être utilisées seulement dans des circonstances exceptionnelles et elles devront comporter uniquement des matériaux approuvés par l'Office pour leur faible taux de toxicité.

CONDITION 17:

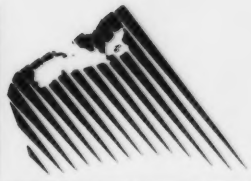
Aucune activité de production hivernale ne devra être conduite au cours de la première année. Toutes les activités de production hivernales pour les années suivantes seront soumises à l'approbation de l'Office.

CONDITION 18:

Tous les navires amiraux étrangers utilisés pour participer aux activités de construction, d'installation, de forage ou de production devront obtenir un Ordre de sécurité pour les bateaux non-canadiens avant d'entreprendre des activités en liaison avec le projet.

CONDITION 19:

Avant le démarrage de la production, le soumissionnaire devra établir un plan recevable par l'Office pour assurer que des fonds suffisants soient prévus en vue d'un abandon adéquat des installations après que la production ait cessé.



1.0 INTRODUCTION

1.1 BOARD AUTHORITY

The Canada - Nova Scotia Offshore Petroleum Board ("the Board") was established by the proclamation of the Canada - Nova Scotia Offshore Petroleum Resources Accord Implementation Act by the Government of Canada, and the Canada - Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act by the Province of Nova Scotia ("Implementation Acts"). The Implementation Acts brought into law the principles established in the 1986 Canada - Nova Scotia Offshore Petroleum Resources Accord ("Accord").

The Board was established as an independent body to manage the petroleum resources in the area offshore Nova Scotia on behalf of the Federal and Provincial governments, in keeping with the provisions of the Accord. The Board is empowered to make decisions respecting petroleum resource activities in the Offshore Area. In the case of fundamental decisions, such as the approval of the general approach to field development, a benefits plan associated with a development, or the terms and conditions of a production license, the Ministers have certain powers as set out in the Implementation Acts to jointly or singularly veto the decisions of the Board.

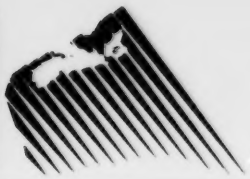
The Board has the power to conduct a public review of any matter within its mandate. To accomplish this, the Board may appoint a Commissioner to conduct a public review, and may establish the time table and terms of reference for the review.

1.0.2. REGULATORY FRAMEWORK

In accordance with the Implementation Acts, prior to undertaking any work or activity in the offshore area relating to developing a pool or field, a Development Plan must be submitted to the Board and approval of this plan must be obtained. This Development Plan must outline the general approach to development giving such details as the location, nature and timing of development, pool and field evaluations, amounts of petroleum to be recovered and production rates, costs, and environmental factors, preferred production systems, and any technical studies required to support the proposed plan.

Before the Development Plan can be approved, the Applicant must also submit and have approved a Canada - Nova Scotia Benefits Plan, also in accordance with the Implementation Acts. The Canada - Nova Scotia Benefits Plan must show how the applicant intends to give Canadians, and in particular Nova Scotia residents first consideration for employment, promote education, training and research and development in the province, give first consideration to Provincial goods and services if competitive in price, quality and delivery, and make provisions for disadvantaged groups to have access to training and employment.

Both ministers must be consulted on the extent to which the Benefits Plan meets the requirements of the Legislation.



1.0.2. CON'T

The Implementation Acts specify that proposed developments must meet the requirements of Regulations established to govern activities relating to offshore oil and gas development. These Regulations will cover such areas as Drilling, Production and Conservation, Installations, Certificate of Fitness, Safety and Health, Diving, Operations, Offshore Pipelines, and Spills and Debris Liability. As of yet, the Governments have not promulgated regulations relating to offshore Petroleum activities, although regulations in many areas have been drafted and are being used by the Board. The draft versions of these Regulations reference the standards and recommended practices of a number of existing industry organizations and regulators. Many of the technical specifications and recommended practices of the American Petroleum Institute are referenced, as well as standards of the Canadian Standards Association. Some of the Oil and Gas Conservation Regulations of Alberta and Guides established by the Alberta Energy Resources Conservation Board are used, as well as certain Transport Canada and Canadian Coast Guard Standards. Where activities relate more closely to the conditions found in the North Sea, certain United Kingdom Department of Energy and Det norske Veritas rules and recommended practices are referenced.

The concept of a Certifying Authority has been adopted under the draft Certificate of Fitness Regulations. The Certifying Authority is an independent organization with recognized expertise which reviews the design, construction, transportation and installation of production, drilling, accommodation and diving installations.

The Certifying Authority will review the project during design, construction, installation and operation to ensure that:

- correct environmental parameters and loading assumptions are used in design;
- the safety analysis meets the requirements of the Installations Regulations;
- proper quality assurance programs are used during construction;
- a proper operations manual is prepared;
- construction and installation is carried out according to design drawings;
- materials used meet design specifications;
- operating limits are detailed;
- design and construction meets applicable regulations;
- the installation is fit for the intended purpose and can be operated safely without polluting the environment;
- proper maintenance and inspection procedures are in place to ensure that the installations remain within the limits established by the Certificate of Fitness.

If all of these items are found to be satisfactory, the Certifying Authority will issue a Certificate of Fitness for the Installation, valid for a defined period of time, detailing all the operating limits of the installation. The installation must be surveyed on a regular basis.

1.0.3 INFORMATION CONSIDERED BY THE BOARD

The bulk of the information considered by the Board is contained in the Development Plan Application and Part I and Part II documents. These documents are substantially similar to the Preliminary Development Application, Appendices and Supplementary Information documents submitted in December, 1989 and considered during the public hearing process from March to June of 1990. The Preliminary Development Application documents were submitted by the Board to a number of agencies for comment.

The Board, along with the Canada Oil and Gas Lands Administration ("COGLA"), and the Nova Scotia Department of Mines and Energy ("NSDME") conducted extensive reviews of the geological, geophysical and reservoir aspects of the Development. COGLA conducted detailed reservoir modelling to test the validity of the work presented by the Applicant. This work identified a number of inadequacies in the reservoir modelling approach, which are being addressed by the Applicant through a more sophisticated reservoir simulation. Board, COGLA and NSDME technical staff held meetings with the applicant to review the detailed working maps and documents used to prepare these sections of the Development Plan.

The marine aspects of the project, and the CALM Buoy and Storage/Shuttle Tanker operations in particular, were evaluated on behalf of the Board by consultants experienced in the industry.

Preliminary reviews of drilling, structures, topsides and safety aspects of the proposed development were reviewed by consultants hired by the Board, as well as COGLA and NSDME staff. Deficiencies arising from these reviews were addressed by the Applicant as further engineering was conducted. Board staff were given access to all design philosophy documents, and detailed drawings considered necessary to conduct a thorough evaluation of the development concept.

The environmental and socio-economic impact of the development was given public review through the Cohasset/Panuke Environmental and Socio-Economic Public Review Commission ("Ellis Commission") under the Chairmanship of Mr. J. R. Pat Ellis. Public information sessions and hearings were conducted during the period from March 22, 1990 to June 27, 1990. Briefs were presented to the Commission by a number of concerned individuals, government agencies and organizations involved in the fishing and marine industries in the area. The Commissioner's report and recommendations were considered carefully by Board staff in preparing the decision report.

The Canada - Nova Scotia Benefits Plan submitted by the Applicant provided the majority of the information assessed by the Board on this aspect of the Project. The Industrial Benefits Office of the Nova Scotia Department of Trade, Industry and Technology and COGLA were consulted extensively on the acceptability of the Plan. The Ellis Commission report also provided information for consideration on the socio-economic benefits of the Project.

PROJECT DESCRIPTION 1.1

The Cohasset/Panuke Development Project is located 41 km southwest of Sable Island, Nova Scotia, as shown in figure 1. The Project is being proposed by LASMO Nova Scotia Limited ("the Applicant") as operator on behalf of themselves and Nova Scotia Resources (Ventures) Limited ("NSRVL"). Each partner has a 50% interest in the proposed Project.

The initial Cohasset D-42 discovery well was drilled, tested and abandoned by Mobil in 1973. Mobil also drilled the Cohasset P-42 delineation well in 1978. This well proved to be a dry hole. A second delineation well, Petro-Canada/Nova Scotia Resources Limited ("NSRL") Cohasset A-52 was drilled, tested, and suspended in 1986.

The initial Panuke B-90 discovery well was drilled and abandoned by Shell in 1986. Petro-Canada/ NSRL drilled the Panuke F-99 delineation well in 1987. This well was extensively tested and, for the first time on the East Coast, produced crude oil was loaded into a tanker moored alongside the drilling and testing jack-up unit.

LOCATION OF PROPOSED DEVELOPMENT SITE

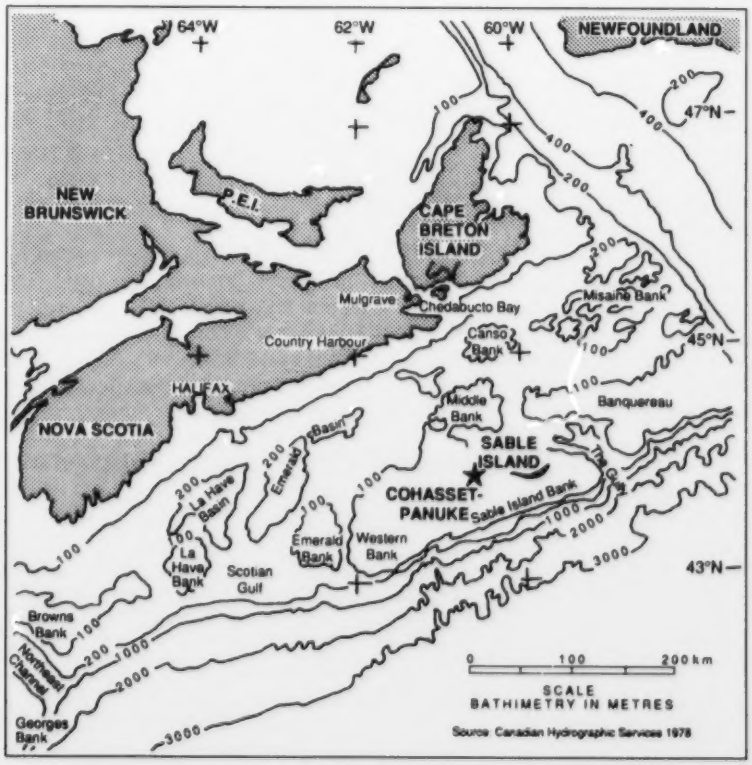


FIGURE 1

NSRVL conducted in-house evaluations to determine the technical and economic merits of Cohasset development followed by additional detailed evaluations through a joint Petro-Canada NSRVL Task Force. These studies concluded that the Cohasset field alone would be a marginal development.

NSRVL continued to evaluate the combined development of Cohasset and Panuke. Various specialist studies were completed to establish baseline technical and environmental data. The Applicant and NSRVL brought together technical data from these sources to compile the plan for the combined development of the Cohasset and Panuke fields.

1.1 CON'T

The Applicant proposes to produce a light crude oil from several Lower Logan Canyon and Missisauga formations in the Cohasset and Panuke fields. Reservoir fluids will be produced through wells supported by two purpose-built steel jacket structures sitting on the seabed and connected by a flexible subsea flowline approximately 9 km long. The oil produced will be processed through separation equipment to remove water and dissolved gas. This separation equipment will be located on a leased jack-up drilling rig situated adjacent to the Cohasset wellhead jacket. Dissolved gas will be used as fuel or flared. Produced water will be cleansed of hydrocarbon contaminants and discharged into the sea. Seawater will be pumped back into the reservoir to maintain pressure. This will require a flexible subsea injection line to the Panuke platform.

The proposed export system will consist of a flexible subsea flowline approximately 2 km long with a flexible riser to a catenary anchor leg mooring (CALM) buoy anchored in approximately 38 meters of water. This will carry stabilized crude oil from the production facilities on the jack-up rig to a storage tanker of 125,000 - 150,000 DWT capacity, moored to the CALM buoy. A dedicated shuttle tanker of approximately 60,000 - 80,000 DWT capacity will be periodically moored to the stern of the storage tanker to offload the storage tanker and transport the crude oil to market destinations.

A schematic of the proposed system is shown in Figure 2.

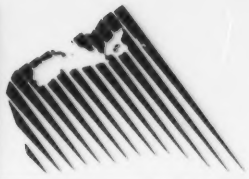
According to the proposed Development Plan, production is scheduled for about seven months each year, for a total of six production seasons, with initial production in 1992. It is planned that the jack-up rig, well jackets, flowlines and CALM buoy will remain on site throughout the winter while the storage tanker will return to port to avoid the period of rough winter weather conditions. The shuttle tanker will be released for other duties. During this period, well and equipment maintenance will be conducted from the jack-up rig. The Applicant has proposed that the storage tanker may return to the field during the winter months to accept production if suitable long term weather conditions can be forecast.

The proposal calls for a year round jack-up drilling and production unit to be used to drill the wells at both Panuke and Cohasset, and then to support the production facilities until project completion. The selected drilling unit will provide all required production support utilities such as seawater, compressed air, drains, electrical power, and safety systems, as well as the accommodations required for drilling and/or production personnel. Figure 3 shows a typical jack-up drilling unit that could be used for the project.

The Panuke wellhead jacket, located in 43 m of water, will be unmanned and will be equipped with a boat landing and helideck for access. Five well slots will be located on this jacket, with initial plans calling for one injector and three producers. The Cohasset well jacket, located in 43 m of water, will have ten well slots available. Initial plans call for five producers and two water injection wells to be drilled. Both well jackets will consist of structural steel tubular frames secured by piles driven into the seabed. The well jackets will be fabricated onshore, transported offshore, and installed using a medium-sized derrick barge. The Panuke wellheads and manifold will be remotely operated from the jack-up located at Cohasset.

Production facilities proposed for installation on the jack-up rig will consist of oil, gas and water separation, water treatment and injection, associated gas flare and fuel systems and integrated safety and control systems. These facilities will be located on the jack-up in areas normally occupied by pipe racks for deep wells.

The Applicant intends to recover approximately 5,550,000 cubic meters of oil from ten sands in Cohasset and two sands in Panuke, during the life of the project. This represents roughly 36% of the original in place reserves. The Panuke sands will be produced concurrently throughout the project life. The Applicant proposes to produce the various Cohasset sands both individually and commingled, requiring frequent re-completion as sands water out. Both fields will require electrically driven submersible pumps to maintain well production as water cuts increase.



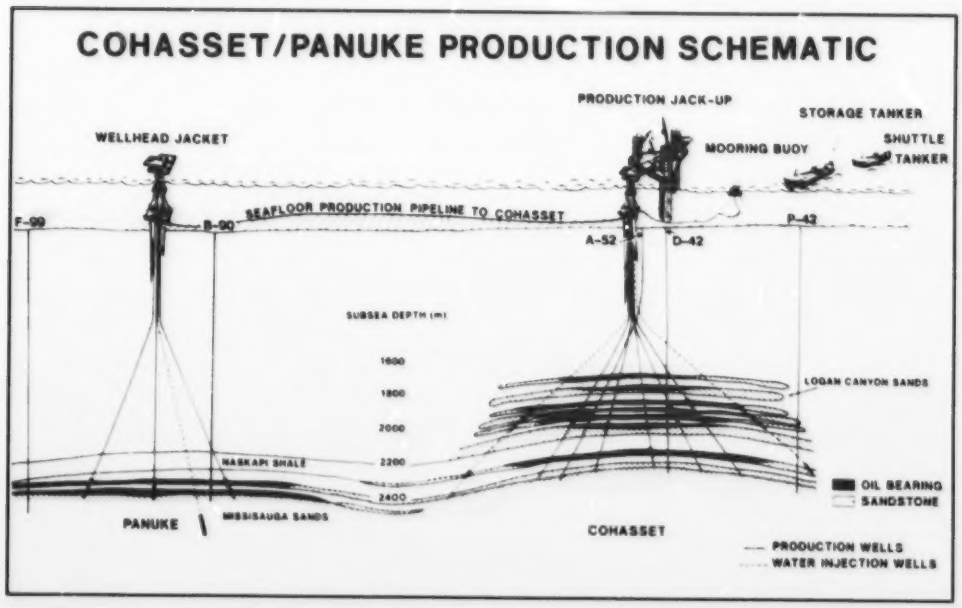
1.1 CON'T

The installation of all offshore components is targeted for the summer months in 1991, with production beginning after completion of the initial Cohasset wells in 1992.

The project is expected to require $160 million in capital funds, with an additional $405 million operating costs.

At the end of the project life, leased equipment will be released. Wells will be abandoned and removed below the seabed along with the wellhead jackets. Flowlines will be retrieved from the sea bed, and the site returned to original condition.

FIGURE 2



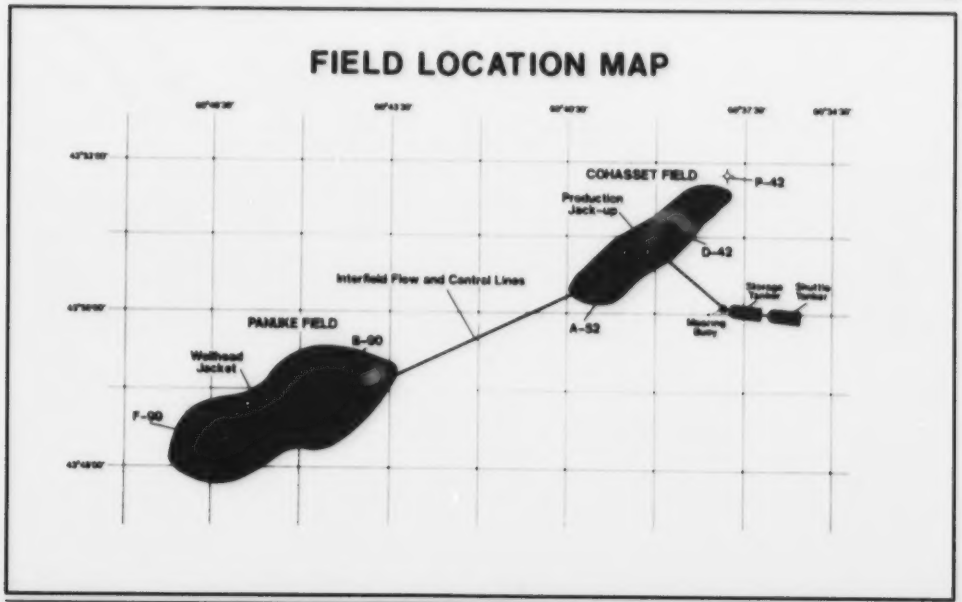
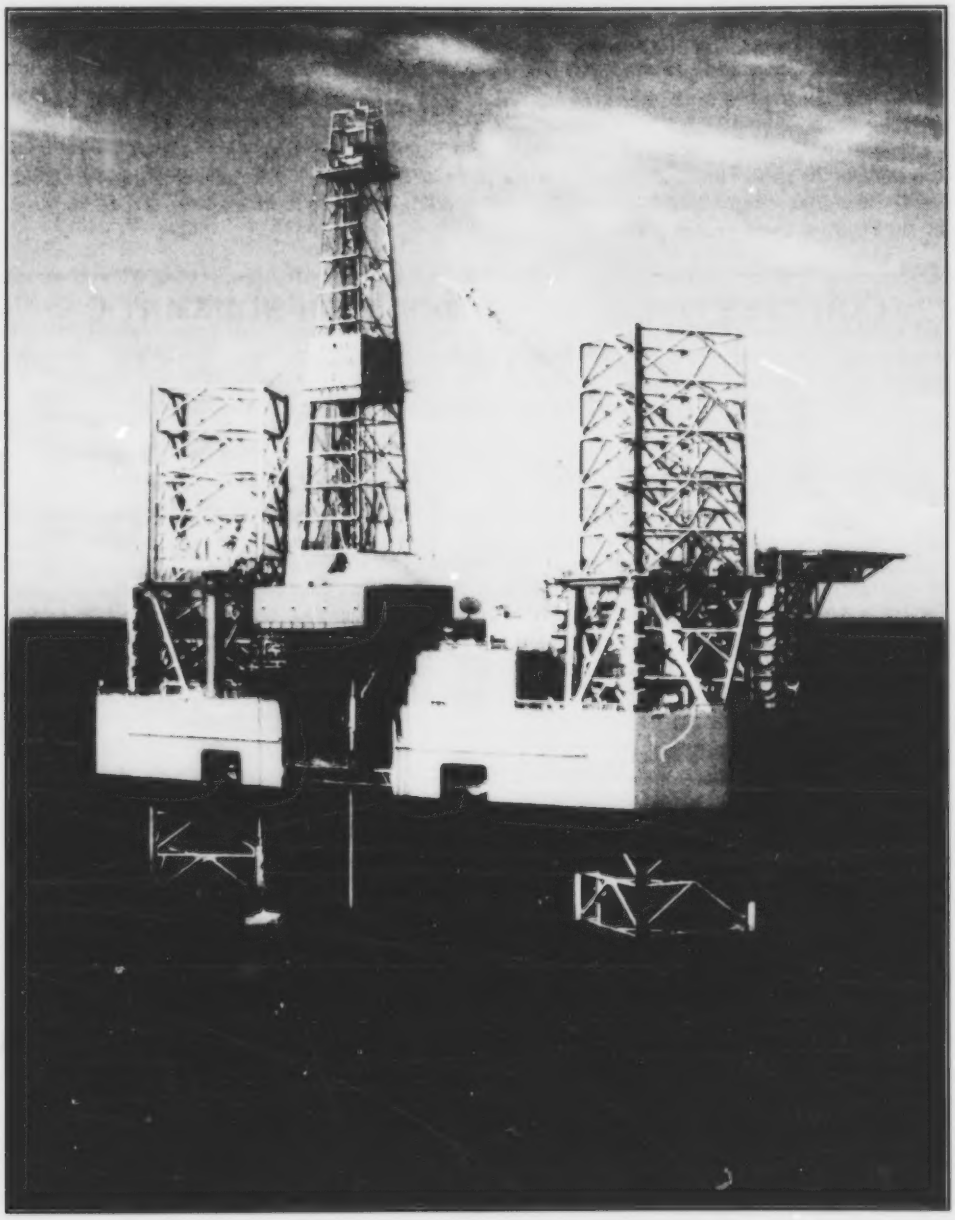
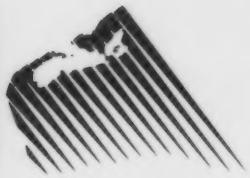


FIGURE 3





DECISION

It is a decision of the Canada - Nova Scotia Offshore Petroleum Board that the Cohasset/Panuke Benefits Plan is approved subject to the conditions contained in this Decision Report.

2.0 INTRODUCTION

The Cohasset/Panuke Benefits Plan ("Benefits Plan") sets forth the Proponent's intentions and expectations of economic benefits from the project to Nova Scotia in particular and to Canada in general.

In its review of the Benefits Plan, the Canada - Nova Scotia Offshore Petroleum Board ("the Board") has given careful consideration to the recommendations of the Cohasset/Panuke Environmental and Socio-Economic Review Commission and, as required by the Legislation, has also consulted with the energy Ministers and officials of both Governments.

The Canada - Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act and the Canada - Nova Scotia Offshore Petroleum Resources Accord Implementation Act ("Implementation Acts") require the preparation by the Proponent and the approval by the Board of a Canada - Nova Scotia benefits plan which shall contain provisions intended to ensure that:

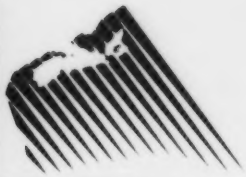
(i) "before carrying out any work or activity in the offshore area, the corporation or other body submitting the plan shall establish in the Province an office where appropriate levels of decision-making are to take place;

(ii) consistent with the Canadian Charter of Rights and Freedoms, individuals resident in the Province shall be given first consideration for training and employment in the work program for which the plan was submitted and any collective agreement entered into by the corporation or other body submitting the plan and an organization of employees respecting terms and conditions of employment in the offshore area shall contain provisions consistent with this paragraph;

(iii) a program shall be carried out and expenditures shall be made for the promotion of education and training and of research and development in the Province in relation to petroleum resource activities in the offshore area; and,

(iv) first consideration shall be given to services provided from within the Province and to goods manufactured in the Province, where those services and goods are competitive in terms of fair market price, quality and delivery."

(Implementation Acts)



2.0 CON'T

In accordance with the requirements of the Implementation Acts, the Board established Benefits Plan Guidelines (May - 1990). These Guidelines have formed the criteria for the review of the Benefits Plan. The Board's conclusions and conditions relating to benefits principles, project execution issues, as well as monitoring and reporting are set forth in this Decision Report.

The Board, in consultation with the Federal and Provincial Energy Ministers, considered a number of regulatory options with respect to maximizing benefits to Nova Scotians and Canadians. After due consideration, the Board has concluded that the most appropriate approach is to secure commitments from the Proponent to a series of basic principles and to closely monitor the performance of the Proponent rather than mandate specific requirements for major elements of the project.

The Proponent is committed to the following objectives in its Benefits Plan:

> ...."maximizing the employment opportunities for qualified Canadians and, in particu lar, residents of Nova Scotia;
>
> maximizing the opportunities for Canadians, and particularly Nova Scotians, to partici pate in the provision of competitive goods and services"
>
> (Benefits Plan)

In addition, the Proponent has also provided the following corporate Statement of Principle:

> "The Cohasset/Panuke Exploration Program and the Cohasset/Panuke Development Project will generate important activity and provide significant opportunities within Nova Scotia and Canada. In recognition of this, LASMO Nova Scotia Limited is committed to using and encouraging capable and competitive Nova Scotian and Canadian companies for the provision of the high quality goods and services required in these Exploration and Development activities."
>
> (Benefits Plan - APPENDIX A)

As a result of these commitments, it is not the Board's intention to direct the execution of any portion of the Project at any specific location or time.

The development and implementation of a benefits plan is by its very nature an evolutionary process. The Board has found the Proponent co-operative, willing to react to the Board's concerns and prepared to comply with the regulatory requirements. Over the life of the Project, the Board will continue to monitor the performance of the Proponent to ensure compliance with all the Benefits Plan commitments.

2.1 PLAN OVERVIEW

The Benefits Plan provides an overview of the proposed project and sets forth scheduled development and production activities in a satisfactory manner.

The Cohasset/Panuke Offshore Development Project ("the Project") is not a major project by world standards. To achieve its economic development, the Proponent proposes to lease or charter the major components of the required installations, including the drilling rig/production platform, the interfield and export flowlines and the export system. Most of this equipment is not readily available from Canadian sources and will be supplied from abroad.

However, there are a number of potential opportunities for Canadian and Nova Scotian firms, particulars of which are as follows:

2.1.1 FABRICATION, MODIFICATION AND INSTALLATION ACTIVITIES.

i) **Wellhead Jackets**. There is existing capability to fabricate these steel piled jackets (Cohasset - 2500 tonnes, Panuke 1500 tonnes) in Eastern Canada. Transportation to the fields and installation would be undertaken by international marine contractors.

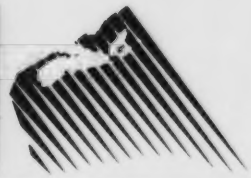
ii) **Production Facilities.** Approximately 700 tonnes of production process facilities including oil processing, water processing, water injection, gas utilization, electrical generation equipment and controls, and oil transfer equipment to be contained in approximately twenty skids, will be required. While specialized components may be supplied from international sources, the manufacture, fabrication, assembly and installation of these production systems on the rig will represent significant opportunities for Canadian and Nova Scotian firms.

iii) **The Export System.** Certain modifications to the CALM buoy and the storage tanker may be required. This work could be handled locally.

Condition 1 :

The Proponent shall investigate and pursue all reasonable opportunities to provide for maximum Canadian and, in particular, Nova Scotian participation in the fabrication and assembly of the wellhead jackets, production facilities and rig modifications and modifications, if required, in the equipment comprising the Export System, and satisfy the Board that the Proponent's packaging of these contracts, their specifications and terms and conditions (including delivery times) has not disadvantaged Nova Scotian and Canadian bidders.

The wellhead jackets, production facilities, and export system represent the principal potential for Canadian/Nova Scotian fabricators. The Board intends to undertake a careful review of the bids for these facilities, prior to contract award, with a view to ensuring that the Proponent maximizes Nova Scotian and Canadian participation.



MANUFACTURING 2.1.2

The Project presents significant opportunities for manufacturers of offshore marine and oil field equipment. Due to its highly specialized nature, very little of this requirement can be supplied by Nova Scotian manufacturers. However, it is anticipated that other Canadian corporations will be competitive and will secure orders for much of this equipment.

EMPLOYMENT 2.1.3

The Project will create important employment opportunities for Nova Scotians and Canadians during both the development and production phases.

i) Development Phase:

- Preliminary Studies, Geophysical and Geotechnical Surveys;
- Project Management and Engineering;
- Development Drilling and Completions;
- Supply and Standby Vessels;
- Shore Base Facilities;
- Helicopter and Airport Services;

The Proponent has estimated that approximately 715 person years of direct employment will be created during the Development Phase from 1990 through 1993 inclusive as follows:

Preliminary Studies	20
Drilling and Completions	210
Wellhead Jackets;	250
Interfield and Export Flowlines	15
Production Facilities	115
Management & Engineering	105
Total	**715**

Canadians and Nova Scotians are anticipated to secure the majority of the employment created by the Preliminary Studies (20), the Drilling and Completions (210) and Management and Engineering (105) activities.

Little participation is anticipated in the Interfield and Export Flowlines (15) as these lines will be constructed using proprietary products and installed by international marine contractors using very specialized equipment.

The extent of participation by Nova Scotians and other Canadians in the manufacture of the Wellhead Jackets (250) will be dependent upon the competitive position of the companies they work for.

The manufacture, assembly and installation of production facilities (115) should contain significant Nova Scotian and Canadian content.

2.1.3 CON'T

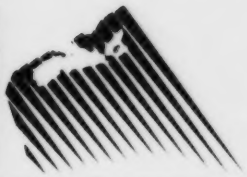
ii) Production Phase

- Management and Engineering
- Production Operations
- Supply and Standby Vessels
- Shore Base Facilities
- Helicopter and Airport Services
- Storage Tanker Operations.

The Proponent estimates approximately 260 person years of direct employment during each year of the life of the project i.e. from 1992 to 1997 inclusive, as follows:

Management & Engineering	35
Producing Operations	150
Tanker Operations	60
Well Workovers	15
Total	**260**

Canadians and Nova Scotians are anticipated to secure most of these positions, but the Board requires more detailed information, (see Condition 4).



FUNDAMENTAL PRINCIPLES AND STATUTORY REQUIREMENTS 2.2

OPPORTUNITY 2.2.1

The Proponent is committed to using, and encouraging, Nova Scotian and Canadian companies capable of providing high quality competitive goods and services in both the development and production phases of the Project. The Proponent's specific industrial opportunity commitments are to:

> "Provide qualified Nova Scotian and other Canadian manufacturers, consultants and service companies with a full and fair opportunity to bid competitively.
>
> Evaluate tenders for goods and services on a 'best total value' basis.
>
> Give first consideration to Nova Scotian goods and services which are competitive.
>
> Attempt to optimize both short and long term benefits to Nova Scotia and Canada.
>
> Design, construct and operate the Project so as to maximize opportunities , as far as practical, in the communities and regions that may be affected."
>
> (Benefits Plan)

EMPLOYMENT 2.2.2

The Proponent's employment commitments are to:

> "Provide fair and equal employment and training opportunities consistent with the Canadian Charter of Rights and Freedoms. Within general employment policies, first consideration will be given to qualified individuals resident in Nova Scotia.
>
> Provide employment opportunities for qualified Nova Scotians and other Canadians ensur ing that performance and safety standards are not compromised."
>
> (Benefits Plan)

PROCUREMENT 2.2.3

In the Benefits Plan the Proponent has expressed its intent to adopt a number of procurement principles. Normal commercial practices will be followed. Equipment and facilities will have to meet the high standards set by industry and Government for offshore installations to ensure safe and efficient operations. Within these contexts, the Proponent has committed to:

> "Ensure that all materials, equipment and services considered for the Project meet the standards necessary to have safe and efficient operation.
>
> Obtain reliable information and understanding of Nova Scotian and Canadian supply and service capability.
>
> Encourage and assist the Nova Scotian and Canadian supply community to identify possible market opportunities.

2.2.3 CON'T

Ensure that the above principles of full and fair opportunity and first consideration will be part of the obligation of the Project contractors and significant subcontractors.

Evaluate bids on a 'best total value' basis. 'Best total value' means the optimum combination of technical acceptability including quality, overall price, delivery, schedule, and service. The benefits to Nova Scotia and Canada including future requirements for similar products or services and the need to develop long term and secure sources of supply will also be considered. First consideration will be given to services from the Province and goods manu factured in the Province where these services and goods are competitive in terms of fair market price, quality, delivery, schedule and service."

(Benefits Plan)

2.2.4 EDUCATION AND TRAINING, RESEARCH AND DEVELOPMENT

The Proponent is committed to:

"Encourage and support the enhancement of Nova Scotian and Canadian technology, expertise and facilities.

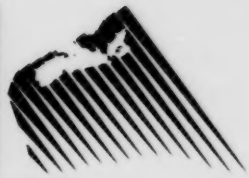
Encourage the transfer of foreign technology and expertise to Nova Scotian and Canadian industry through joint ventures, licensing arrangements or other mechanisms.

Contribute to the improvement of manufacturing and fabrication skills in Nova Scotia and Canada in order that offshore development and production standards can be achieved."

(Benefits Plan)

2.2.5 CONCLUSIONS

The Board is of the opinion that these commitments adequately meet the requirements of the legislation and properly reflect the Proponent's agreement to provide full and fair opportunity to Canadians, including giving first consideration to Nova Scotians. In the matter of employment, the Board has chosen not to set or establish specific levels or percentages of Nova Scotian or Canadian employment for each major component of the Project. In the Board's opinion, the interests of all parties are best served by securing employment commitments from the Proponent (and indirectly from its contractors by means of succession plans), undertaking ongoing project monitoring, and continuing to have close consultations with the Proponent.



POLICIES AND PROCEDURES 2.3

INFORMATION 2.3.1

The Proponent has undertaken to provide information on the Project to the Board and other interested parties, and has committed:

> "to provide information describing Project Development, production programs and procure ment and employment needs to the Canada - Nova Offshore Petroleum Board, government agencies, and to interested groups in Nova Scotia.
>
> LASMO will provide Project information to any agencies, institutions, or communities to assist in assessing the need for changes to programs or infrastructures.
>
> LASMO will maintain an active communication with the business community, and provide useful information on Project requirements and opportunities through written material, meetings and seminars (i.e., OTANS, Board of Trade, etc.)."
>
> (Benefits Plan)

PROJECT MANAGEMENT 2.3.2

The Proponent has undertaken to meet the Board's Guidelines concerning the management of the Project. It has established its head office in the Province to undertake therein the management, engineering and administration of the Project. It has actively encouraged participation by Nova Scotian and other Canadian engineering firms, manufacturers and suppliers in the development, packaged its bid requests to facilitate participation by both large and small Nova Scotian firms in the bidding process, requested Nova Scotia and Canada Benefits information from bidders including succession plans, where appropriate, agreed to the establishment of a local supply base and implemented management systems and procedures to ensure the optimization of Nova Scotian and Canadian Industrial Benefits.

SUPPLIER DEVELOPMENT 2.3.3

The offshore support services capability developed within the region during the early to mid eighties will be revitalized by this project. In the Benefits Plan, the Proponent is committed to entering long term agreements with its local suppliers, to encouraging such organizations to enter into joint ventures, licensing arrangements and similar mechanisms with foreign companies to enhance their capability, expertise and knowledge, and to otherwise promote the development of reliable domestic sources for goods and services that will be required over the life of the project.
These undertakings adequately respond to the Board's requirements relating to supplier development.

2.3.4 EDUCATION AND TRAINING, RESEARCH AND DEVELOPMENT

The availability of a trained labour force with previous oil and gas related experience, both onshore and offshore, and the size of the project minimizes the requirements for the training of personnel. Some specialist training, for example, the use of simulators to train Masters on berthing at single point moorings, will be undertaken outside the region. However, training to meet regulatory and/or industry requirements, such as Drilling Simulation, Marine Emergency Duties, First Aid, Fast Rescue Craft, Helicopter Ditching at Sea, and Basic Survival Training will be carried out in Nova Scotia.

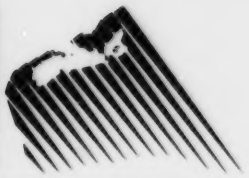
Condition 2:

The Proponent shall make use of Nova Scotian and Canadian training facilities where available and competitive.

The Proponent does not envisage the use of new technology, systems or equipment in the pursuit of this project. As such, no pure research is proposed or contemplated.

The Project will provide unique opportunities to universities and local research facilities to study and evaluate such topics as scour potential adjacent to platforms and flowlines.

With the condition above, the Board is satisfied with the Proponent's commitments to maximize the use of local training facilities and will not require the Proponent to make specific undertakings respecting research and development.



PROCUREMENT REQUIREMENTS 2.4

DEVELOPMENT PHASE 2.4.1

In the Benefits Plan, the Proponent defines the nature of its requirements for equipment and materials, the majority of which will be utilized during the Development Phase of the Project.

In related correspondence to the Board, the Proponent has defined its contracting strategy and procurement plans. It has undertaken to revise and update these requirements on a quarterly basis.

The Board will continue to monitor contracts in terms of reviewing those firms identified by the Proponent as being qualified to bid and to approve all commitments in excess of $250,000 prior to contract award.

Condition 3:

The Proponent shall provide advance notice to, and consult with, the Board at the prequalification stage of all contracts and shall submit bidders lists for all contracts for Board review. The Proponent shall provide advance notice to, and consult with, the Board at the contract award stage of the procurement process for contracts and/or purchase orders having a value in excess of $250,000. The time required for review of these materials will be determined by the Board in consultation with the Proponent.

PRODUCTION PHASE 2.4.2

The Proponent has not provided, in its Benefits Plan or otherwise, documentation of the annual demands for goods and services required to support production operations, as required by the Board.

The Board recognizes that the current Project schedule leaves little opportunity for detailed consideration of future activities at this time. The Board is satisfied with the generality of the Proponent's intentions, however, the Proponent is expected to meet the requirements of the Board's Benefits Guidelines concerning these details.

Condition 4:

The Proponent shall submit, by October 31, 1990 estimates of Nova Scotian, Canadian and foreign expenditures for both capital and operating costs, broken down into major Project components, for both the development and production phases of the Project. The Proponent shall submit, 30 days prior to the beginning of each new calendar year, detailed estimates of its annual requirements for goods and services to support production operations. These are to include projections of quantities, values, and the timing of its requirements, as well as probable sources, together with an assessment of the capability of Nova Scotian and Canadian industry to meet these requirements.

2.5 LABOUR REQUIREMENTS

2.5.1 DEVELOPMENT

The Proponent has provided estimates of total direct employment on an annual basis, to be generated by the Project in person years, for each of the major components of the Development Phase, a summary of which are as follows:

Year	Person Years of Direct Employment
1990	165
1991	385
1992	110
1993	55
Total	715

2.5.2 PRODUCTION

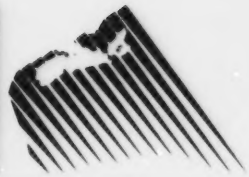
Similar figures have been provided for the Production Phase, by area of operations, on an annual basis:

Area of Operations	Person Years of Direct Employment Annually
Management	35
Production	150
Tanker	60
Well Workovers	15
Total	260

The Board requires the Proponent to outline the potential for participation by Nova Scotians and Canadians in all aspects of the project. Demand estimates by skill classification, in accordance with the Canadian Classification and Dictionary of Occupations are to be provided, for each phase of the Project, in terms of Nova Scotian, Canadian and foreign residency. Of particular interest to the Board is the Proponent's assessment of Nova Scotian and Canadian labour available to fill these positions. The Benefits Plan fails to provide the required information.

Condition 5:

The Proponent shall provide, by October 31, 1990, estimates of the annual requirements for labour by skill classification in accordance with the Canadian Classification and Dictionary of Occupations, and the proportion that can be filled by Nova Scotians and Canadians, for each major component in both the development and production phases of the Project. The Proponent shall submit Succession Plans for positions not initially filled by Nova Scotians and Canadians.



CONSULTATION, MONITORING AND REPORTING 2.6

Both the Board and the Proponent recognize the need for close consultation over the life of the Project. The Proponent has committed to

> "Work closely with the Board.....to keep them informed on a timely basis about LASMO's plans and procurement activities."
>
> (Benefits Plan)

As the Board has chosen not to establish component specific benefits criteria for the Project, close consultation and effective monitoring and reporting will be required to ensure that benefits objectives are achieved.

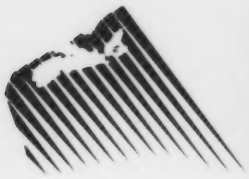
The Board neither believes it to be necessary nor productive to monitor all of the Proponent's procurement decisions. To this end, the Board will not routinely review contract awards of less than $250,000, nor any award when all of the bidders are Nova Scotian. The Board will continue to review all the Proponent's invited bidders lists, and bidder prequalifications on all other proposed contracts.

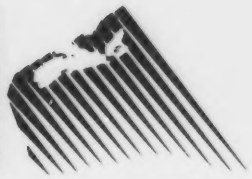
In addition to the above, the Proponent has committed to on-going monitoring of its own, and its sub-contractors' performance. The Proponent will

> "- Establish a procedure for monitoring and reporting actual and Nova Scotian content.
>
> - Monitor Project contractors and significant sub-contractors to ensure that they adhere to LASMO's Nova Scotian and Canadian industrial reporting commitments.
>
> - Compare actual performance to plans.
>
> - Require contractors to complete the Canadian/Nova Scotian content questionnaires as a condition of acceptance of their tender. This information will be used as a benchmark of their Canada/Nova Scotian benefits performance.
>
> - Ensure that contractors and significant sub-contractors meet Canada - Nova Scotia Offshore Petroleum Board reporting requirements."
>
> (Benefits Plan)

The Proponent has indicated its willingness to comply with the Board's reporting requirements; namely to provide Quarterly (periodic) and Annual Benefits reports, within appropriate due dates.

The Board is generally satisfied with the Proponent's commitments to the consultation, monitoring and reporting process.





DECISION

It is a decision of the Canada - Nova Scotia Offshore Petroleum Board that the Cohasset/Panuke Development Plan Part I and Part II is approved, subject to the conditions noted in this Decision Report.

3.0 INTRODUCTION

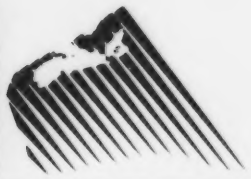
A Development Plan, along with an application for approval was submitted to the Board by LASMO Nova Scotia Limited on behalf of themselves and Nova Scotia Resources (Ventures) Limited on July 17, 1990. This was preceded by a Preliminary Development Plan submitted to the Board in December of 1989, and a Canada - Nova Scotia Benefits Plan submitted on June 22, 1990. Public information sessions and hearings were conducted on the Preliminary Development Plan from April to June 1990.

The Development Plan sets forth the Applicant's plans for development of a pool or field. The Canada - Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act and the Canada - Nova Scotia Offshore Petroleum Resources Accord Implementation Act ("Implementation Acts") require that a Development Plan be approved before any work relating to the development of a pool or field is carried out offshore Nova Scotia. The Implementation Acts require that the Development Plan be laid out in two parts:

> "(a) in Part I, a description of the general approach of developing the pool or field, and in particular, information, in such detail as may be prescribed, with respect to
>
> (i) the scope, purpose, location, timing and nature of the proposed development.
>
> (ii) the production rate, evaluations of the pool or field, estimated amounts of petroleum proposed to be recovered, reserves, recovery methods, production monitoring procedures, costs and environmental factors in connection with the proposed development, and
>
> (iii) the production system and and alternate production systems that could be used for the development of the pool or field; and
>
> (b) in Part II, all technical or other information and proposals , as may be prescribed, necessary for a comprehensive review and evaluation of the proposed development."
>
> (Implementation Acts)

Throughout the Development Plan, the Applicant indicates its desire to conduct a safe, environmentally responsible operation, its commitment to adhere to good engineering practices, and the requirements of all applicable legislation and regulations.

As stated in 1.0.2, the regulations governing activities have been drafted but have not yet been promulgated by the governments of Canada and Nova Scotia for the offshore region. For the purposes of the Cohasset/Panuke Project, the Board has adopted the Federal version of various regulations and draft regulations and makes adherence to them a condition of this approval. These regulations and draft regulations are referred to hereafter in this Decision Report as the "Regulations".



3.0 CON'T

Condition 1:

Until specific regulations are promulgated for offshore Nova Scotia, the Applicant shall comply with the provisions of all pertinent regulations, including but not limited to the following regulations or draft regulations as if they were in force with respect to the offshore region of Nova Scotia.

Canada Oil and Gas Installations Regulations
(Oct. 12, 1989, DRAFT)

Canada Oil and Gas Production and Conservation Regulations

Canada Oil and Gas Occupational Safety and Health Regulations

Canada Oil and Gas Diving Regulations

Canada Oil and Gas Drilling Regulations

Canada Oil and Gas Certificate of Fitness Regulations
(March 21, 1990, DRAFT)

Canada Oil and Gas Operations Regulations

Canada Oil and Gas Spills and Debris Liability Regulations

Prior to the issuance of a Production Operations Authorization, the Applicant shall provide the Board with the following:
- a declaration which states the installation and equipment used in the development are fit for the intended use, the operating procedures are appropriate and the employees are competent and qualified to operate the installation and equipment;
- a certificate, issued by an approved Certifying Authority, that verifies that the installation and equipment are fit for the intended use and comply with all applicable regulations.

3.0 CON'T

In addition, the governments are proposing certain safety related amendments to the Accord Implementation legislation. Although not in force at this time, the Board also adopts the philosophy proposed in these amendments. These amendments require the Applicant to appoint an Offshore Installation Manager ("OIM") with qualifications satisfactory to the Board, who will be responsible for the safety of the installation and of all persons on it and who will be given the powers necessary to effect this responsibility.

The approval of the Development Plan is only one of the Board approvals which will be required before the Cohasset/Panuke Project goes into production. Each operation conducted in the offshore area will require written approval from the Board before being undertaken by the Applicant. The Applicant will be asked to submit additional reports and plans for Board approval, both as requirements under the regulations and as additional information to satisfy the Board prior to issuance of a Production Operations Authorization or Drilling Program Authorization. Some of the plans and reports required are:

- a development well coring program which ensures all sands anticipated to be used for production or injection are cored to obtain as much information to characterize the reservoir as possible;
- a prediction of the potential for scour or burial of seabed installations including plans for ongoing inspection and mitigating procedures;
- a plan to monitor the pressure integrity of and detect leaks in the flowline from Panuke to Cohasset;
- a Safety Plan written for the specific equipment used on the project, including, among other things:

  - detailed operating procedures identifying environmental limits for operations of all installations involved in the Project including procedures for protecting the installations and personnel on board during adverse weather conditions;

  - detailed operating and maintenance procedures designed for the specific equipment procured for the Project;

  - a training program detailing mandatory safety training for all personnel, as well as specialized training and qualifications required for specific jobs.

- a Contingency Plan annexed to the Safety Plan, identifying all foreseeable emergencies, and including, among other things:

  - an Emergency Response Plan for responding to all foreseeable emergencies;

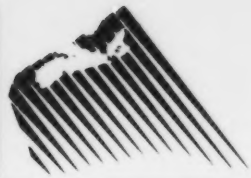
  - a program to deal with loss of well control detailing methods to eliminate or control hazardous situations:

- an Environmental Protection Plan detailing the Applicant's plans to minimize any adverse conse quences of the Project on the environment, including, among other things:

  - a plan to monitor waste disposal operations for compliance with environmental regulations and guidelines, and to monitor the effects of any discharges on the environment;

  - a report detailing the equipment and procedures to be used to dispose of any water separated from produced oil during the time it is stored in the storage tanker;

The Board will ensure that sufficient time is provided to properly assess these plans and reports prior to approval.



Geology and Petrophysics

3.1

The Applicant has used the Petro Canada Cohasset geology and core analysis studies to support its interpretations of the depositional environments of the reservoir sandstones. Given the well density in the area of the fields, small sizes of the fields and the thoroughness of the above reports, very little else can be added to the interpretations at this time. Subsequent future drilling and analysis of recovered core will no doubt enhance, refine and/or possibly modify the present interpretations. At this point, however, the Applicant's interpretations of the depositional environment are sound.

The core analysis studies by Petro Canada (Cohasset) and Shell (Panuke) were evaluated by the Applicant to confirm the interpretation of sandstone porosities and permeabilities. A comparison of the two reports revealed close agreement on the parameters used and overall results obtained by these studies, thus rendering any re-evaluation of the core data unnecessary at the present time. No deficiencies were revealed in these reports, and the Applicant plans to incorporate the parameters defined by Petro-Canada and Shell into core analyses following the development drilling program. Additionally, if warranted by the results of future core studies, the investigation of relative permeabilities on the existing core will be undertaken.

The response of the Applicant to the deficiencies noted in this section of the original application has been very good. All requests for clarifications, additional data, larger/more legible copies of data, and other minor points within the text have been promptly dealt with. In such cases where the re-submission of data and/or figures has been delayed, notification of this has been passed on to the appropriate Board Staff. As well, new requests for additional information or data have been fulfilled in a timely manner.

Overall, the Geology and Petrophysics sections of the application are very well done and fulfill current requirements as set forth by the Board.

3.2 GEOPHYSICS

3.2.1 PANUKE

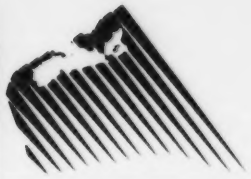
Five interpretations of the seismic data relevant to the Panuke area were taken into consideration for the assessment of the development plan. This included work done by consultants on behalf of the Applicant as well as independent evaluations conducted by Shell, COGLA, NSDME and Board staff. The duplication of work at Panuke resulted from the absence of 3-D seismic control which allowed for interpretational differences.

Various direct and indirect methods were used to map the pay sands and different depth conversions were utilized. All of these interpretations agreed with the basic shape and size of the reservoirs and identified similar areas where the interpretation could be subject to change. The 3 and 5 meter contours on the net pay map containing the bulk of the reserves, fell within structural closure on all interpretations of this structure. The western lobe on the net pay map containing 1 to 3 meters of pay may have been questionable and subject to change but it contributed only a small amount to the total reserves estimates.

A 3-D seismic survey was completed during the first week of July 1990. These new data will show the Panuke structure in much more detail than is presently possible and should clarify the interpretation at the western end of the structure. Presently no faults appear to impact the reservoir sands but the 3-D data may resolve small faults which could affect injection or production well locations. No significant change in reservoir size is expected but fine tuning will no doubt occur.

3.2.2 COHASSET

The Cohasset structure had 3-D seismic coverage which provided for much more accurate mapping. The evaluation completed by Petro-Canada in 1986 was studied by the Applicant, COGLA, NSDME and Board staff. All agreed that this interpretation appeared to accurately represent the reservoirs. These seismic data are currently being reprocessed by the Applicant but no significant changes in the present mapping are expected.



RESERVES AND RECOVERY 3.3

RESERVOIR PROPERTIES AND OIL-IN-PLACE 3.3.1

Oil-in-place was calculated volumetrically by the Applicant at 8,146,000 cubic meters for Cohasset and 7,234,000 cubic meters for Panuke. Each reservoir contains a high API gravity undersaturated crude oil with a very low gas-oil ratio. Independent evaluations by COGLA and NSDME staff were in general agreement with this evaluation. Porosities, net pays and water saturations as determined by the Applicant from well logs and confirmed through core analysis are considered reasonable by the Board. Oil/water contacts determined from well logs and RFT test pressures also appear reasonable.

Structure mapping was determined to be satisfactory, and is discussed in Section 3.1 and 3.2 of this report. Permeabilities were estimated from drill stem test analysis and verified by core analysis. Although some discrepancies were evident, the Board is satisfied that the Applicant's explanation of variances and the selection of final properties for use in the reservoir simulation is reasonable.

DEPLETION STRATEGY 3.3.2

The Applicant proposes to deplete the reservoir using primary recovery only with pressure maintenance through injection of seawater to completely replace voidage. The Applicant states that evaluation of enhanced recovery methods would be too speculative to be useful at this time. The Board agrees that this strategy is acceptable as a starting point, but leaves substantial reserves in the ground which may prove economic to recover as more is learned about the reservoir.

The Applicant has assumed that there will be little or no pressure support from the aquifer for the purpose of worst case injection system design and oil recovery prediction. The Board agrees that this approach is conservative, and that active aquifer support could enhance reserve recovery and reduce injection requirements. However, the Board also feels it is necessary to determine as early as possible in the life of the reservoir the degree of pressure support to be expected from the aquifer and the need for make up of reservoir voidage, particularly in light of anticipated incompatibility between formation water and injected seawater. This should be possible to assess with Cohasset, as water injection is not planned until the second year.

Condition 2:

Prior to injection of seawater into either the Panuke or Cohasset reservoirs, the Applicant shall conduct sufficient tests to determine the degree of pressure support from the aquifer. This condition does not apply to re-injection of produced water.

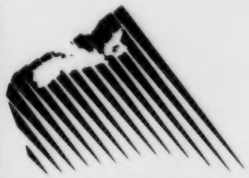
3.3.3 RECOVERABLE RESERVES

The Applicant plans to recover 2,869,000 cubic meters of oil from the Cohasset reservoir and 2,682,000 cubic meters of oil from Panuke, for a total of 5,551,000 cubic meters. This represents an average of 36% of in place reserves, with recoveries from individual sands ranging from 7% to 46%. Estimates of recoverable reserves by some reviewers were as low as 3,975,000 cubic meters from the two fields combined. Several reviewers were skeptical that the Applicant could achieve 36% recovery in a producing period of only forty-two months from relatively thin sands, many with underlying water and some with evidence of fractures. This skepticism is supported by Western Canadian experience where this level of recovery is often not achieved after 10 to 15 years in reservoirs with much closer well spacing than is possible in an offshore situation.

The Applicant claims that there are special circumstances, such as a favorable mobility ratio (Cohasset and Panuke crudes are much lighter and less viscous than typical Western Canadian crudes, with viscosities approaching that of water) and high permeability which improve recoveries substantially. The Board agrees that these factors will be beneficial to increased recovery of reserves. Independent reference sources indicated that oil recoveries from areas of the reservoir swept by water could range from 25% to 56%. However, the ability to sweep all areas of the reservoir has not been established. Poor vertical and/or horizontal sweep efficiencies will reduce the amount of reserves recovered.

The Applicant has attempted to assess the effect of variations in reservoir parameters and recovery efficiencies on recoverable reserves through the use of a Monte Carlo type probability simulation. This simulation shows that there is a 60% probability of recovering the 5,550,000 cubic meters shown by the Applicant as recoverable reserves. This level of confidence fits more closely with industry definition of proven plus probable additional reserves, rather than proved reserves. The simulation shows that there is an 85% probability of recovering close to 4,530,000 cubic meters, which is more in line with industry definitions of proved reserves. Results of Monte Carlo simulations are dependent, like any computer model, on the data input to the model. The Board agrees that the input parameters for the model are reasonable, except that most likely average recovery factor and water saturations are somewhat optimistic. Board estimates of these two factors shift the probability curve lower by approximately 25%.

Overall, the Board's assessment is that the Applicant's stated reserve recovery levels of 5,550,000 cubic meters represent an optimistic case and that recoveries will likely be closer to 4,000,000 cubic meters, consistent with the probability analysis above. However, the Board feels that this recovery level still represents a viable project and that the proposal still represents an acceptable development strategy. The Board also recognizes that careful reservoir management will be vital if these recoveries are to be improved.



RESERVOIR SIMULATION 3.3.4

The original reservoir simulation work was deficient in a number of areas. The coarseness of the grid used required that an artificial adjustment to relative permeability data be made to avoid premature water breakthrough in the simulation. Production from individual sands could not be linked together, making it difficult to determine the crossflow between zones in the commingled wells during the winter shut in periods. Sand by sand, well by well production and injection forecasts were not given. Faults indicated on tests were not used in the reservoir model.

The Applicant is revising the simulation using a more powerful simulation model (ECLIPSE) which will address many of the problems noted above. The reservoirs are being simulated on a much finer grid, removing the need to adjust relative permeability curves. All sands from both reservoirs are being modelled at once, with some sands being made up of distinct layers. The simulation allows shut in of wells at the sand face, or at the surface which will allow crossflow to occur during shut in. Faults are still not input specifically. However, the Applicant indicated that observed faults should be in water zones on the reservoir flank and have little effect on the simulation results. The reservoir is being modelled as a closed system with limited aquifer support. The possible effect of fractures was not modelled because of the lack of confirmed data and the difficulties in accurate modelling.

The Board feels that the updated simulation model using the ECLIPSE computer model will take the reservoir simulation as far as is reasonable with the data currently available. Major questions on sand continuity, reservoir heterogeneity, natural fractures and aquifer extent and support cannot be answered or refined until further drilling and testing is conducted. Crossflow between sands will be highly dependent on reservoir characteristics near each individual well, as well as the efficiency of the final completion on each sand.

The Board feels that the reservoir simulation, once developed, will be a valuable reservoir management tool when the reservoir description is updated as new wells are drilled and well production history is available.

COMMINGLING 3.3.5

The Applicant states that it will be necessary to commingle production from certain sands at Cohasset and Panuke in order to economically recover the reserves. At Cohasset, the Applicant proposes to commingle sands 5,6, and 7, and also sands 2 and 3. At Panuke, sands 2 and 3 will be commingled throughout the life of the field. The data given shows that producing Cohasset sands 5, 6 and 7 separately could technically recover an extra 70,000 cubic meters of oil (0.5% recovery). However, the Applicant states that this additional oil would not be possible to recover economically because of economic rate constraints. The Board feels that while this may be true, insufficient backup information has been provided to show that commingling of zones is required for economic depletion of the reservoir. Therefore, commingling of sands is specifically prohibited unless an application, supported by more detailed information is approved by the Board.

3.3.6 PRODUCTION/INJECTION FORECAST

The Applicant has proposed a production forecast which will keep the flow rate from the field constant at 4530 cubic meters per day from the two fields combined for the first four producing seasons, declining rapidly during the last two seasons to a low of approximately 1410 cubic meters per day at abandonment. The zones completed and produced at any given time are adjusted to limit maximum water production to 6210 cubic meters per day. In the Cohasset field, the length of time a given well is completed in an individual zone varies from one producing month up to twenty eight producing months. Individual zones are depleted using from two to four wells out of the five. In Panuke, both sands are completed in all wells for the entire producing period.

The Board feels that the overall producing rates in the forecast are acceptable. The rate of take (approximately 1:1200) is high relative to most conventional Canadian producing fields. However, the Board recognizes that these rates are economically necessary for this project because of high fixed operating costs associated with offshore operations. The Board will ensure that production from individual wells is limited to rates which will not damage the reservoir or harm ultimate recovery.

It is the opinion of the Board that the production forecasts and completion strategies for individual sands in the Cohasset field need further optimization. The Board would prefer to see individual sands depleted through as many wellbores as possible to ensure that reservoir sweep efficiency is enhanced. The Board also questions why Cohasset Sands 0 and 1 are not included in the latest production forecast.

The proposed production forecast and completion schedule for Panuke are satisfactory.

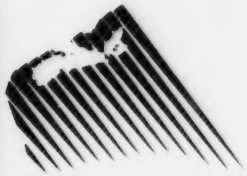
Proposed water injection and voidage replacement strategy in the Panuke field is satisfactory. Proposed voidage replacement ratios for sands 2, 3 and 6 in Cohasset are unacceptably high. The Board feels that some means will be required to control injected volumes into each sand to ensure Voidage Replacement Ratios remain close to 1.0 in each sand.

3.3.7. GAS CONSERVATION

The Board agrees that because of the undersaturated nature of the reservoir, insufficient gas will be produced to warrant expenditures for re-injection equipment. The Board understands that studies have shown that electrical power generation using gas turbine units is feasible and has positive economics, although that interface to the existing drilling generation system may result in some control problems.

Condition 3:

Produced gas shall be used as fuel to produce electrical power needed for all new production equipment. The Applicant shall investigate ways to mitigate equipment compatibility problems to enable existing drilling rig electrical requirements to be supplied by produced gas fired generation during the production season.



PRODUCED WATER DISPOSAL 3.3.8

The Applicant has indicated that the mixing of produced water and sea water in the injection system is highly undesirable because of the formation of precipitates. The Board recognizes that this can cause severe problems with the injection system which should be avoided if possible. However, the studies done to date are based on computer models using very old produced water samples and "typical" seawater analysis requiring a number of assumptions which could prove inaccurate. The Board will require tests to be conducted on representative samples of produced water and seawater to confirm previous work.

The production/injection forecasts show that the volume of formation water produced from both Cohasset and Panuke is sufficient to supply approximately 110% voidage replacement for the Panuke field. This may make injection of all produced water into Panuke an attractive alternative. Further conditions on injection/discharge of produced water are made in section 3.4.3.

RESERVOIR MANAGEMENT 3.3.9

The Board wishes to emphasize that, because of the limited data available for the reservoir simulation, and the short time period proposed for depletion of the reserves, good reservoir management will be extremely important on this project. There will be very limited time available to recover from problems. This will require gathering reliable, accurate production history and reservoir information. The applicant will require sufficient flexibility in equipment to adjust production strategy when assumptions prove to be wrong.

The Board believes that the Applicant has provided sufficient flexibility in the facilities to be installed. Three spare well slots will be available in Cohasset, and one spare in Panuke with the possibility of converting one injector to production, with a subsea injection completion. Production and injection facilities will have some flexibility in throughput. The export system will have adequate flexibility to adjust to production rates.

The Board agrees with the Applicant's plans to include a coring program in each development well. The development well coring program submitted should include oriented core where possible to assist in reservoir characterization and confirm log interpretation and fracture geometry if present.

The reservoir simulator will be a valuable tool for monitoring reservoir performance, but will require accurate well production history. This data will require accurate measurement of test and group production, and injection, and proper proration to individual wells and zones. Plans submitted to date in this area are not satisfactory. The re-circulation of second stage separator water to the first stage separators will make direct measurement of field production impossible. The applicant must be able to determine the overall production from each of the Cohasset and Panuke fields directly without proration, or measurement by difference. Test measurement equipment for the Cohasset field appears satisfactory, but further details are required on proportional sampling equipment for the oil stream. Overall custody transfer measurement and meter proving appear acceptable, but will require proportional sampling to determine water carried over to the storage tanker.

The proposal to test two Panuke wells through the separator at one time to determine the production of a third well is not acceptable. All wells must be tested individually on a regular basis to obtain an accurate measurement of well production. However, the low bubble point pressure of the Panuke crude will minimize the amount of entrained gas at wellhead conditions. This may allow the use of mass flow meters on individual Panuke well streams to assist in proration and on line water cut determination.

3.3.9 CON'T

Considering the accelerated rate of take proposed for the reservoirs, changes in water cut from a well could occur very rapidly. This necessitates more frequent monitoring of individual well performance.

Condition 4:

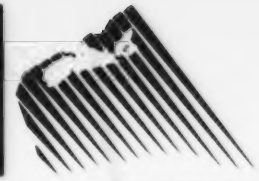
The Applicant shall submit a detailed metering schematic and proration procedure showing all metering points to be used in calculation of well and field production, including procedures for determining accurate water cuts. The Applicant shall also submit an analysis of the metering system accuracy and the resulting well test frequency required, using the procedures set out in the regulations.

An important part of reservoir management will be the determination of production profiles, including sources of water, for wells with zones commingled at the sand face. The final completion configuration chosen should accommodate the frequent production logging which will be required to monitor reservoir performance.

The Applicant states that coning will be inevitable at economic production rates, unless physical barriers to vertical permeability are present in the formation. The Board feels there is sufficient evidence from the DST analysis to indicate that water production may be rate sensitive to some extent. The Board will ensure that the Applicant conducts tests to determine this sensitivity as soon as water production from a sand is indicated.

The Applicant has indicated a number of possible ways to monitor production for breakthrough of injected water, but does not state a specific program to be followed. The Board will ensure that a satisfactory program is defined.

The Board understands that the Applicant intends to address most of the specific issues in this section in a Reservoir Management Plan and Reservoir Simulation Update to be prepared prior to production start up. The Board wishes to emphasize the importance of this document .



3.3.9 CON'T

Condition 5:

The Applicant shall submit to the Board a detailed Reservoir Management Plan prior January 1, 1991. The plan shall be prepared using all available technical data or interpretations as well as the reservoir simulation update currently underway. The Plan shall be updated on a regular basis as the Project proceeds. The Plan shall:

- ***describe the updated reservoir simulation model, including the reservoir description used and the results of the latest simulation runs on which the depletion strategy is based;***

- ***reassess the completion schedule submitted in the development plan in an attempt to increase the number of wellbores used to deplete each sand, and the time taken to produce each sand;***

- ***indicate the frequency at which the Applicant intends to update the reservoir simulation model as the project progresses;***

- ***address the depletion strategy for sands 0 and 1;***

- ***provide a revised injection schedule designed to maintain a Voidage Replacement Ratio between 0.9 and 1.1 for each sand;***

- ***address the economic and technical feasibility of secondary and enhanced recovery;***

- ***include specific plans to monitor for injected water breakthrough.***

The plan shall be prepared assuming that all sands are produced with segregation in the wellbore, unless specific approval of the Board is obtained.

3.4 ENVIRONMENTAL MANAGEMENT & SOCIO-ECONOMIC IMPACT

As part of the Preliminary Development Application, the Applicant was required to include an assessment of the potential environmental and socio-economic consequences of the proposed project. The Board submitted this assessment to the Ellis Commission in February 1990 for an independent and public assessment of its accuracy and acceptability, and for a recommendation about whether the project should proceed as proposed, proceed with modifications, or not proceed at all. The Ellis Commission completed its review in July 1990. The Board has accepted the findings of the Ellis Commission and has incorporated all the recommendations in this Decision Report.

During the public review of this information by the Ellis Commission, a number of government agencies and fishing community representatives provided comments and recommendations relating to the potential interaction between the development project and the environment. Many of these statements were directed towards matters falling under the Board's regulatory regime at later stages in the planning process. These cannot be thoroughly addressed until the Applicant completes a more detailed design of its project. However, the Board is committed to seeking the participation of other government agencies, the fishing community and others in the review of subsequent proposals submitted by the Applicant for approval.

The formal arrangements for establishing a consultative approach with federal and provincial government agencies will be embodied in Memoranda of Understanding which the Board intends to sign with them. The Ellis Commission has recommended that the Board make every effort to finalize these Memoranda at an early date in order that all parties clearly understand their roles and responsibilities. The Board agrees with this recommendation and has been actively pursuing its responsibility in this regard. In the spring of 1990, it prepared draft Memoranda of Understanding relating to the 'Environment' and the 'Fishery' and circulated them to the relevant federal and provincial agencies. It is currently waiting for responses from the representatives of these departments.

3.4.1 PHYSICAL ENVIRONMENT

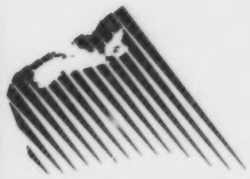
The Applicant prepared a description and analysis of the meteorological, oceanographic and ice conditions in the vicinity of the project site. As part of this analysis, the Applicant determined average and extreme values for these conditions in the vicinity of the Cohasset/Panuke development site.

These values serve as the basis for determining the design of offshore facilities. In order to obtain the highest level of accuracy possible for these values, the Board will ensure that they are subject to review and certification by the Certifying Authority.

The Department of Fisheries and Oceans, in its submission to the Ellis Commission, recommended that the Applicant establish systems for routinely measuring the physical state of the marine environment. The Board agrees with this recommendation and notes that the regulations require that the Applicant submit programs for observing, forecasting, and reporting physical oceanographic, meteorological and ice conditions for approval.

The Board has reviewed the information on the physical environment provided by the Applicant as well as the assessments of this information which were made by the Ellis Commission and by technical experts in other government departments.

In general, the Board has concluded that the information provided by the Applicant on the physical environment, meets the requirements of the Development Application Guidelines.



FISHERY ISSUES

3.4.2

The fishery is a renewable resource that is central to Nova Scotia's culture, particularly its economic aspects.

Two of the principal regulatory objectives of the Board are to protect the fishery from potentially adverse effects associated with the activities of the oil and gas industry and to promote harmony between these two major offshore industries as a means of optimizing the economic opportunities associated with the marine environment. In attempting to achieve these objectives, it is a fundamental principle of the Board that, in the first instance, the two industries should attempt to resolve outstanding issues on a private and voluntary basis where environmental resources are not at risk.

A safety zone around the development area is required by the regulations in order to protect the production, storage and related facilities. The Board will establish this zone in consultation with all interested parties.

The Applicant has recommended a safety zone around the two well sites, the tanker stations and the connecting pipelines and hoses. Submissions made to the Ellis Commission by the fishing community are largely devoid of expressions of concern about the nature of this zone. However, the Board does not interpret this observation to imply that the fishing community has no concerns in this regard. Rather, it interprets this as a reflection on the effectiveness of the current level of consultations between the Applicant and the fishing industry.

The Board agrees with the Ellis Commission that the Applicant should prepare, in consultation with the fishing industry, procedures for promoting compliance with the provisions of the safety zone and that these procedures should be effectively communicated to the captains of fishing vessels and supply boats. The Board also agrees with the recommendations of the Ellis Commission that the Applicant work with the fishing industry to establish procedures for notifying fishing vessels of project-related vessel traffic.

Condition 6:

Prior to the issuance of a Production Operations Authorization, the Applicant shall submit to the Board a plan for promoting compliance with the provisions of the safety zone. It shall include ways and means for communicating the elements of the plan to the captains of fishing vessels and supply boats and for notifying the fishing industry of project related vessel traffic. This plan shall reflect the input of the fishing community.

Under the Implementation Acts, the Applicant is responsible for compensating fishermen for losses directly attributable to its actions. The Board also agrees with the recommendation of the Ellis Commission that the compensation plan must address questions relating to fouling of fishing gear, pre-emption of fishing activity, and tainting. The Applicant has met with representatives of the fishing community and has agreed to establish a compensation package for attributable damage to the fishery. It has also agreed to work with fishermen to develop an approach for compensation arising from loss of access to fishing grounds due to the presence of spilled oil relating to the Project.

The Board intends to offer assistance, if requested, to the parties in their efforts to develop a mutually acceptable compensation program and will only impose a program if such efforts fail.

3.4.2 CON'T

The fishing industry has expressed concern that compensation may not be available to fishermen suffering losses from the activities of third parties employed on the project. The Ellis Commission has recommended that the Applicant address this concern prior to the initiation of project construction. The Board agrees with this recommendation.

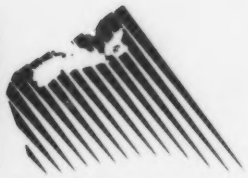
Condition 7:

Prior to conducting any project related offshore activities, the Applicant shall submit to the Board, for approval, a plan to compensate fishermen for attributable damage arising from the activities of third parties as well as its own activities. This plan shall reflect the input of the fishing community and it shall outline an approach to effectively communicate its provisions to that community.

During the public hearings, the fishing industry highlighted the importance of the linkage between environmental effects monitoring and compensation. It recommended that representatives from its industry be involved in the development of the monitoring program and the review of the results. The Ellis Commission has recommended that the fishing industry be provided with an opportunity to review both the compliance and environmental effects monitoring program prior to approval by the Board. It also recommended that representatives from the fishery be involved in monitoring the operations of the Project. The Board is in full agreement with these recommendations and will not only seek the participation of the fishing industry in the monitoring programs but will also encourage the Applicant to involve the fishing industry in the design of these programs.

As a final comment, the Board is aware that it cannot guarantee that the proposed project will not, at some time and in some way, affect some part of the fishery. However, it does administer a number of procedures, the implementation of which will serve to markedly reduce the potential for such adverse interactions. Some of these have already been implemented. For example, the Board required the Applicant to identify the nature of the fishery in the project area and to assess the risk of the project to it. Furthermore, it requested the Applicant to identify how it plans to manage the control of unforeseen incidents and, where such incidents may lead to damage to some part of the fishery, the Board requested that the Applicant identify how it intends to compensate those who are adversely affected. The Board submitted this information to a third party, the Ellis Commission, which it established to provide an independent and critical review of the Applicant's environmental evaluation including the potential impact of the project on the fishery. It instructed the Commission to conduct this review in public where individuals, private organizations, and government agencies would have an opportunity to submit comments as well as recommendations and supporting documentation. The Commission has provided the Board with a number of recommendations which it believes will contribute to the protection of the fishery. The Board, in turn, has adopted these as conditions for approval of the project.

The first phase of the project review process is complete. Subsequent phases will require the Applicant to undertake such activities as further safety analysis, subject to review by the Certifying Authority, and the completion of contingency, compensation, and monitoring programs. In addition to ensuring that these regulatory requirements are met, the Board reiterates its intention to encourage the Applicant to continue to involve the fishing community in appropriate aspects of project planning. The Board itself intends to seek the views of the fishing industry prior to the approval of proposals relevant to the fishery. It is the Board's view that the adherence to this rigorous regulatory regime will substantially enhance sound project planning and hence reduce the risk of damage to the fishery.



ENVIRONMENTAL PROTECTION

A principal element of the Board's mandate is to ensure that offshore operators implement measures to protect the environment from the effects of oil and gas activities. Accordingly, the Board required the Applicant to prepare an assessment of the effects of its proposed project on the environment in the area of the Cohasset/Panuke development site and to submit it to a public review.

In its assessment, the Applicant compiled a description of the environment which included an outline of the natural variability of environmental parameters and an evaluation of the adequacy of the data bases used to evaluate impacts. The Venture Environmental Impact Statement, prepared by Mobil Oil Canada Ltd. in 1983 and subsequently reviewed in public by the Canada-Nova Scotia Sable Island Environmental Assessment Panel, was the principal source of baseline information. The Applicant updated this information base with more recent scientific and technical data collected from studies conducted on the Sable Island Bank since that time.

The Applicant has assessed the potential effects of routine project operations associated with construction and installation, drilling and completion, production, and abandonment. This assessment evaluated the environmental effects arising from discharges such as produced water and bilge water into the marine environment, from emissions of substances such as engine exhausts and natural gas into the atmosphere, and from the presence of noise, lights, and workers. The Applicant concluded that the environmental impacts from these activities would be negligible.

In an intervention submitted to the Ellis Commission, Environment Canada recommended that the Applicant restrict the use of oil in drilling fluids to those situations where its use is essential to maintaining the integrity of the operation. Evidence indicates that the discharge of cuttings produced during drilling with certain types of oil-based muds can affect the marine environment although the magnitude and significance of these effects has not been determined. The Applicant has indicated its intention to use water-based drilling muds. In situations where oil must be added to the drilling fluid, the Applicant has stated that it will use only products that have a low toxicity rating in place of diesel fuel which is the more conventional product. It is a regulatory requirement that any use of oil in drilling muds must be reported to the Board (see condition 16).

During the public review, a number of interveners expressed concern about the potential environmental effects of produced water discharged into the sea, particularly the effects of oil contained in that water. Both Environment Canada and the Department of Fisheries and Oceans recommended that produced water should be injected into the reservoir structure or into another formation. The Applicant responded that this strategy would add significantly to the weight on the production platform and to the cost of the project. It has proposed instead to treat the produced water to meet or exceed government regulatory requirements prior to discharging it into the marine environment. In support of its strategy, the Applicant cited evidence demonstrating that the discharge of treated produced water would not cause any significant effect to the marine environment.

The Board concludes, based on scientific and technical evidence, that the discharge of treated produced water from the Cohasset/Panuke project into the open ocean will not have a significant effect on the marine environment. This view is further supported by the proceedings of the Ellis Commission in which no new evidence to the contrary was provided by interveners or the Commission's technical experts. However, the Board acknowledges the concerns expressed by interveners and it therefore accepts the recommendations by the Ellis Commission that the Applicant further consider the economic and technical feasibility of injecting produced water into subsurface structures. If further analysis confirms that subsurface injection is not feasible, the Applicant will be required to submit the results of the analysis to the Board.

3.4.3 CON'T

If the Applicant demonstrates that subsurface injection is not a feasible option, it must provide the Board with a report outlining how it intends to treat produced water. Although the Offshore Waste Treatment Guidelines, published by COGLA and the Canada - Newfoundland Offshore Petroleum Board require an oil content of less than 40 mg/L in waste water discharges, the Board agrees with the Ellis Commission that the Applicant should consider treatment systems capable of achieving an oil content that is less than 25 mg/L as described by Environment Canada in its Environmental Code of Practice for Treatment and Disposal of Waste Discharges from Offshore Oil and Gas Operations ("the Environmental Code of Practice").

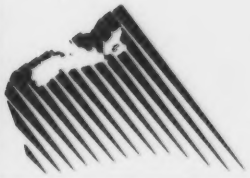
Condition 8:

Prior to the issuance of a Production Operations Authorization, the Applicant shall further investigate the feasibility of injecting produced water into the reservoir structures. This investigation shall include the feasibility of injecting all produced water into the Panuke reservoir during the production season, and making up voidage in the Cohasset field using seawater injected during the winter shut-in period. If a viable option is not found, the Applicant must provide the Board with appropriate documentation for its consideration. Where subsurface injection is not possible, the Applicant must either adopt treatment systems capable of achieving 25 mg/L, as described in Environmental Code of Practice, or provide the Board with evidence supporting the position that this level cannot be achieved.

As noted in section 3.4.5, the Board also intends to ensure that the Applicant develop an approved program to monitor the environment for potential effects associated with activities at the project site, including the discharge of produced water as recommended by the Department of Fisheries and Oceans.

The Applicant presented an assessment of the potential environmental impact of accidental events which addressed issues related to potential oil spills, chemical spills, and the effects of activities designed to manage the control of such incidents. This assessment included an evaluation of the probability of spills arising from pipeline leaks, blowouts, and tanker accidents, and an analysis of the probable fate and effects of spilled oil. It identified tanker accidents as the greatest risk to the environment in the vicinity of the project. However, because of the nature of the oil, the Applicant concluded that discharges from a catastrophic release of oil resulting from such an accident would dissipate rapidly. The Applicant's analysis of the potential trajectory of a spill of this nature indicated a surface slick would dissipate before reaching Sable Island, even under circumstances where conditions were most favorable to the movement of oil in that direction.

The effect of all categories of spills on the marine environment were assessed by the Applicant. It concluded that a spill would cause mortalities in the vicinity of the oil slick and sub-surface cloud, but that the overall effect on the marine environment would be minor.



3.4.3 CON'T

The Board is concerned about the potential for adverse effects of oil in the marine environment from all sources. It intends to pay particular attention to ensuring that measures are in place for minimizing the potential for accidents resulting in the release of oil. These include ensuring that production facilities and related infra-structure meet all safety standards and codes, that offshore personnel have or receive training commensurate with their responsibilities, that operating weather and sea state limits are developed, approved, and followed, and that tanker loading procedures are similarly managed. With respect to this latter point, the Ellis Commission has recommended that the Applicant submit an operating plan to the Board which identifies environmental limits, as well as procedures, for the transfer of oil from the platform to the storage tanker and from the storage tanker to the shuttle tanker.

The Board agrees with this recommendation and notes that the Applicant has committed to establish such limits and procedures.

Condition 9:

Prior to the issuance of the Production Operations Authorization, the Applicant shall submit to the Board for approval a plan which identifies the environmental limits and the procedures for oil transfers between the platform, the storage tanker, and the shuttle tanker.

The public review generated a number of interventions advocating the use of double hulled tankers as a means of protecting the marine environment from catastrophic oil spills. The Applicant has proposed to use storage and shuttle tankers which will meet the protective location requirements, with respect to segregated ballast tanks, that are specified in the 1978 Protocol to the International Convention on the Prevention of Pollution from Ships 1973 (MARPOL 73/78). The Applicant has also indicated its commitment to ensure that the tankers will be staffed by highly qualified Masters supported by well-trained officers.

Having given due consideration to the potential of the oil from the development to cause damage during a pollution event, and to its volatility and hence safety requirements, the Board has concluded that the use of double hulled tankers, which represent less than ten percent of the world's tanker fleet, are not required. However, the Board concurs with the findings of the Ellis Commission that the Applicant's commitment to employ vessels which comply with the relevant MARPOL standards related to segregated ballast tanks should be formalized (see Condition 15). These standards currently exceed those applying to Canadian vessels.

The Board also agrees with the recommendation made by a number of interveners at the public hearings, that well qualified and experienced personnel represent an effective precaution against the occurrence of accidental or emergency events which could result in oil spills. The Applicant has indicated its commitment to implement this recommendation. The Board will ensure that the marine facilities are appropriately staffed with qualified personnel.

The Ellis Commission has recommended that the Board take the lead in determining how to ensure that the Applicant complies with its proposal to have project related traffic avoid "The Gully", an area where many species of marine animals concentrate. The Board agrees with this recommendation (see Condition 14). It will work with interested parties to monitor the location of such routes when production begins.

The Board is satisfied that the information provided by the Applicant meets the requirements of the regulations and that the development proposal, which includes measures to mitigate adverse effects on the environment, will not have any significant environmental effects.

3.4.4 ENVIRONMENTAL PROTECTION PLAN

The Environmental Protection Plan is essential for the protection of the environment from potentially adverse consequences of developments. In its final form, such a plan provides a detailed outline of the procedures that will be used to comply with regulations and other requirements related to environmental protection.

The Applicant has outlined the scope of its environmental protection plan. The plan will include a statement of the Applicant's environmental policy, and will outline programs for employee orientation and education, environmental inspection, reporting procedures, contingency planning, conflict resolution, and mechanisms for environmental decision making.

It is a requirement for subsequent offshore activity approvals associated with the project, that the Applicant prepare an environmental protection plan and submit it to the Board for approval. The Board agrees with the recommendation by the Ellis Commission that the interests of other government agencies and the fishing community should be considered prior to the approval of the plan. In this regard, it is the intention of the Board to seek the advice of government authorities and resource users which have responsibilities or interests associated with the contents of this plan.

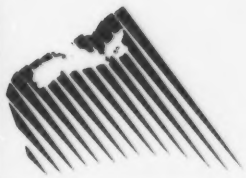
3.4.5 COMPLIANCE AND EFFECTS MONITORING

Compliance and effects monitoring programs are used by government and industry to obtain information that will assist in managing the environmental effects of developments throughout their life span.

The purpose of a compliance monitoring program is to provide assurance to the Board that wastes from the Applicant's activities are disposed of in the manner prescribed by regulations or guidelines. The purpose of an effects monitoring program is to determine if the Applicant's activities are causing changes to the environment. Where changes do occur, such monitoring can assist in determining where to make appropriate modifications to the operation.

The Applicant has outlined the elements of its compliance monitoring program which include promoting internal communication for enhancing environmental decision-making, assigning clear responsibilities for various aspects of monitoring, providing education and training for staff and contractors, and submitting monthly reports to the Board and other government agencies. With respect to its effects monitoring program, the Applicant has presented an outline of the principles underlying its approach. Further, it has stated that it plans to focus its program on studies that generate information essential to making decisions about the environmental acceptability of its proposal, and on studies that evaluate the accuracy of predicted impacts or that contribute to the refinement of mitigation or compensation programs. It is the intention of the Applicant to establish a multi-disciplinary team of experts to assist it with the technical design of its monitoring program.

The Board requires the Applicant to submit to it, for approval, plans for both compliance and effects monitoring before proceeding with the implementation of offshore activities. As recommended by the Ellis Commission, the Board intends to establish a committee to advise it on monitoring matters including the review of monitoring plans prior to their approval and the review of monitoring results. The Board also agrees with the Ellis Commission that this committee should provide advice on procedures for regular monitoring. The Committee itself will be comprised of representatives from government agencies with resource expertise or regulatory interests in environmental protection and from the fishing industry.



CONTINGENCY PLANNING

3.4.6

The Applicant has presented an outline of the proposed strategy for developing a comprehensive alert and response plan to address any emergency situation affecting life, property, and the environment. The plan will outline alert procedures to provide advance notice of potential emergency situations, as well as response procedures documenting actions to be taken during an emergency event. It will include information on supplemental sources of emergency personnel, equipment and materials as well as data required to support operational and emergency planning.

A number of participants in the public hearings expressed concern about the potential for collisions arising from the intrusion of ships into the safety zone. The Ellis Commission recommended that provision be made for the regular review of diversion procedures. The Board agrees that this is a necessary requirement to ensure the continued commitment of the Applicant to ensure that on-duty offshore personnel remain alert. The Board will undertake to conduct regular reviews with the Applicant on the effectiveness of its diversion procedures.

With respect to a spill involving oil from the Cohasset/Panuke project, the Applicant has stated that standard methods of containment and recovery are unsafe and ineffective because of the volatility of the oil. It has outlined its intention to monitor the fate of any spilled oil, including concentration levels, as a means of determining its potential for tainting marine organisms.

The Ellis Commission has recommended that the Applicant should submit a plan outlining the procedures that will be used to alert personnel to initiate protective actions under adverse weather conditions. In addition, it has recommended that this plan should clearly indicate the chain of command and identify decision-making responsibilities under normal, alert and emergency conditions. The Board concurs with these recommendations and notes that, by regulation, the Applicant is required to submit a detailed contingency plan to the Board prior to initiating offshore development activities. The regulatory guidelines used for the preparation of the Contingency Plan require operators to include alert procedures in these plans.

The Ellis Commission also noted that the Applicant's contingency plan should include procedures to locate and move a rig capable of drilling a relief well to the development site for the purpose of drilling a relief well. The Board agrees with this recommendation and notes that this is already a requirement of existing regulations.

Condition 10:

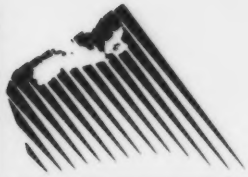
During development and production, the Applicant shall monitor the location and status of, and demonstrate the availability of, drilling units capable of expeditious deployment for drilling a relief well in the event of loss of well control at the Cohasset and Panuke fields. The results of this monitoring shall be reported to the Board on a weekly basis.

The Board is satisfied that the Applicant's approach to contingency planning is appropriate for the nature of the project and that it meets the requirements of the regulations.

3.4.7 SOCIO - ECONOMIC CONCERNS

The Board acknowledges the recommendation of the Ellis Commission that it should encourage the Applicant to attempt to use, to the extent possible, the Mulgrave facilities for a supply base. The Board hereby conveys the Commission's recommendation to the Applicant.

The Board cannot identify any negative impacts to Nova Scotia in reviewing the social and economic issues related to the Project. The Project is relatively small in comparison to offshore production developments, but it will bring to Nova Scotia the first offshore production installation in Canada. The Board feels that, due to the size of the Project, there will be minimal impact on items such as social services, housing, public infrastructure, and labour requirements. However, experience gained in local engineering, material sourcing/fabrication, installation and operating the facility will provide an excellent base line for future developments. Overall, the Board feels this is an excellent size project with which to commence development.



GEOTECHNICAL

3.5

Bathymetry was established from several sources, including the Canadian Hydrograhic Service and site specific surveys. Water depths at the jacket sites were confirmed from echosounding and physical measurement during geotechnical boring programs. This work is acceptable to the Board.

Sediment transport and seabed scour are not well defined in the area of the proposed development. The Board agrees with the Applicant's stated intent to conduct studies which will include inspections and surveys after major storms to quantify sediment transport/scour activity. These studies should address the wellhead jacket sites as well as the flowline/export line routes, and should result in a forecast of scour potential for the life of the project.

Geotechnical boring programs were conducted at both wellhead jacket sites. Results at Panuke showed no impediment to the installation of piles or well conductors. At Cohasset, practical refusal was encountered at approximately 92 meters below the seabed. While this should not cause a problem for wellhead jacket piles, this depth coincides closely with the proposed driving depth of well conductors.

The Applicant's assessment of earthquake hazards at the site is acceptable. The parameters established should provide sufficient basis for the Certifying Authority to assess the adequacy of proposed installations.

The Board agrees with the Applicant's assessment that subsidence due to reservoir depletion will not be a factor.

The Applicant completed a comprehensive Engineering/Geophysical seabed survey of the Cohasset/ Panuke Development area for the identification and mapping of potential and possible impediments to drilling operations. The Board has received a report which specifically assesses the existence of shallow gas as a possible hazard to the development during construction, drilling or operations.

3.6 PRODUCTION SYSTEM

3.6.1 CERTIFICATION PLAN

The Certifying Authority chosen by the Applicant for the Cohasset/Panuke Development is Lloyd's Register of Shipping. This is one of the four Certifying Authorities approved under the draft regulations.

The Scope of Work set out for the Certifying Authority by the Applicant has been submitted and approved by the Board as required by the Regulations. The Board is satisfied that the scope of work ensures that all areas required by the regulations will be covered.

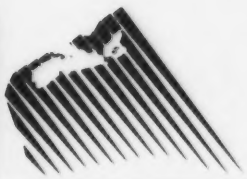
3.6.2 WELLHEAD JACKETS

The tubular steel jacket piled to the sea floor is a well known and established structure for the production of offshore oil and gas in many areas of the world. Structures of this type are in common usage in the Gulf of Mexico, the North Sea and the Pacific. Much attention has been devoted in recent years to the development of steel structures to be used in the production of small, marginal fields, and a number of structures similar in concept to that proposed by the Applicant are currently in service. The Board agrees that the use of this type of steel jacket to support wellhead, production manifold and flowline riser equipment as proposed is a viable approach to the development of the Cohasset/Panuke fields. Access to wellheads will be easier than with subsea completions, allowing more frequent logging and testing of wells which will be an important part of managing the depletion of the fields.

Although the detailed design philosophy for the jackets is not laid out specifically in the development plan documentation, the Board requires that the structure's design will be in accordance with, and cover all areas required under the regulations. These areas include a stress analysis under extreme loads, fatigue analysis, stress analysis during transportation and installation, corrosion protection and maintenance/inspection as well as other specifics. The Certifying Authority will review fabrication quality assurance and control programs and fabrication procedures to ensure that the requirements of Canadian Standards Association Z-299 Standards, or equivalent, are met.

The type of corrosion control measures proposed by the Applicant for the submerged, splash and atmospheric zones of the jacket are acceptable under the Installations Regulations. A detailed inspection and maintenance program is not given, but is required to be approved by the Certifying Authority prior to issuance of a Certificate of Fitness.

The Applicant proposes to equip both the Panuke and Cohasset jackets with a permanent boat landing for access when a rig is not present. The Panuke jacket will also be equipped with a helideck. This will allow access to the Panuke wells during the project life, and to the Cohasset site during the five to six month period while the rig is drilling Panuke wells and the Cohasset jacket is unattended. This is satisfactory to the Board.



SUBSEA FLOWLINES

3.6.3

The Applicant has identified a flexible pipe system as the preferred alternative for subsea flowlines. The regulations reference Det norske Veritas Technical Note - Flexible pipe and hoses for submarine pipeline systems as a suitable standard. This type of piping system has been used extensively worldwide in the offshore. The operating conditions proposed for this development are well within the range of the materials available to manufacture the lines. Installation can be accomplished in the offshore environment found at the Cohasset/Panuke sites without difficulty, and may eventually simplify the retrieval of the lines when the facility is decommissioned. Therefore, the Board approves the use of flexible pipe for subsea flowlines.

The subsea flowline will be required to cross a subsea communication cable, located between the Cohasset and Panuke sites. The Applicant has indicated that discussion is under way with the cable owner to agree on a satisfactory flowline crossing construction.

Condition 11:

The Applicant shall submit to the Board for approval, prior to flowline installation, details of the proposed method to protect subsea cables from damage during installation and operation of a subsea flowline crossing over the cable and shall show that the cable owner's permission has been obtained for the crossing.

The Applicant originally stated that corrosion protection was not required.
After a Board request for clarification, the Applicant indicated that a program of routine disassembly and inspection supplemented with corrosion coupons and ultrasonic thickness testing will be implemented. This is satisfactory to the Board.

The Applicant's proposed volume balance system for leak detection between the platform and storage tanker is acceptable.

The Applicant has not addressed the subject of leak detection in the production or injection flowline, but will be required to do so before production commences.

3.6.4 PRODUCTION EQUIPMENT AND FLUID TREATMENT

The Applicant has proposed a simple two phase separation system as the primary method of oil treatment, with the possible addition of steam preheat of the incoming fluids prior to separation. Production facilities will be located on the deck of the jack up rig, in areas normally required for tubular goods storage when drilling deep wells. Utilization of this space for process equipment will not be detrimental to drilling operations due to the relatively shallow well depths at Cohasset and Panuke. Equipment layout and spacing depends on final rig selection, but will be in accordance with the regulations.

The Board agrees with the Applicant that additional oil treating in the form of a coalescer or heated treater is not justified in this case because of the light crude oil and low emulsion forming tendencies shown. The 3 - 5% water content specification proposed should be easily achievable with the 3 minute retention time proposed for the separators. The additional settling time available while the crude sits in the storage tanker awaiting shipment combined with a small bottoms cleanup system will further enhance this separation.

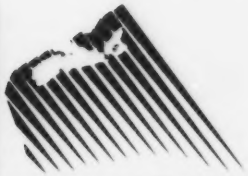
The maximum Reid Vapour Pressure specifications of 75 kPa for the crude oil product is adequate.

The Applicant is not specific on the type of equipment and procedures to be used for produced fluid measurement and sampling. The control system as shown on the schematic flow sheets generally leads to a variable flow rate condition through the meter which must be taken into account when deciding on meter proving rates. Fluid sampling procedures should be in accordance with the applicable sections of the American Petroleum Institute - Manual of Petroleum Measurement Standards. Automatic sampling to obtain a proportional fluid sample is strongly recommended.

The proposed produced water treatment system consists of a proprietary centrifugal type separator. This is a relatively new design, but in installations to date has proven capable of meeting the design effluent quality.

The system proposed to treat sea water for injection is typical for oil field injection water treatment. To prevent corrosion of injection equipment and potential leaks, as well as to avoid plugging of the injection wells resulting in lower oil recoveries, it is necessary to remove suspended solids and dissolved oxygen from injection water, and ensure that no bacteria are permitted to grow in the system. This will be accomplished through the addition of fungicides, bactericides and corrosion inhibitors to injection water. The Board agrees with the Applicant that the treatment process proposed is appropriate for the project.

The fuel gas system does not allow for dehydration of the fuel gas. Hydrate formation could occur at temperatures significantly above freezing with the heavy molecular weight solution gas anticipated. The Board will ensure that the Applicant identifies critical fuel gas supplies such as flare pilots and purges and dehydrates fuel gas supplies to these areas.



PROCESS CONTROL, PROTECTION AND EMERGENCY SHUTDOWN SYSTEMS 3.6.5

The Applicant proposes to use a variety of systems to control process conditions and protect equipment, personnel and the environment from damage. Primary process control will be through the use of pneumatic and electronic instrumentation with a proven track record in offshore oil and gas installations. This equipment will maintain various levels, pressure, temperatures and flow rates within the design range of installed equipment.

Process operators will be able to monitor process conditions and equipment status and set operating parameters from a central control room.

As a first level of protection, critical process variables will have out of limit alarms. These alarms will identify, through audible and visual alarms in the central control room, areas which require operator intervention to return the process to a normal condition. Typical alarms of this type would be high or low fluid levels, high pressure in vessels, high temperatures or pump malfunctions.

Should the process variable continue to range further from established set points, the second level of protection would initiate a controlled automatic shutdown of the process. This would typically consist of shutting off flow at the wellhead, blocking in flowline risers, closing inlet valves to the process vessels and opening valves to vent hydrocarbons in the process vessels to the flare system. The flare system is designed to ensure that these vented hydrocarbons are burned in a manner which will protect the production platform and environment from damage, as specified in the regulations.

As a third level of protection, vessels and piping will be equipped with mechanical pressure relief valves which relieve pressure to the flare system when pressure nears the maximum allowable working pressure established for the vessel. These would only come into play if the control system and process shutdown system were unable to maintain the process in a safe condition.

The Applicant will be installing combustible gas detection and fire detection systems in accordance with the regulations. Gas detection systems give an operator alarm and initiate a shutdown before the point where an explosion or fire could occur. The fire detection system will initiate an emergency shutdown on detecting a fire and identify the location of that fire to the operator. An emergency shutdown will block in wells below the sea floor, shut in all flowlines and process equipment, and shut off any sources of fuel or ignition. Only systems required for controlling the emergency, such as communications and fire fighting would be left operational. Start up after an emergency shutdown would required clearance from the OIM.

Process control and emergency shutdown systems proposed by the Applicant are satisfactory in the opinion of the Board.

3.6.6 LIFESAVING EQUIPMENT

Lifesaving equipment will be installed on the drilling/production installation in accordance with the regulations. Lifesaving equipment on the drilling rig will also cover the Cohasset wellhead jacket when the drill rig is on site. The Board recognizes the reduced need for lifesaving equipment on a not normally manned installation such as the Panuke jacket. Therefore, the lifesaving equipment requirements for the Panuke platform have been reduced in accordance with the latest draft of the Installations Regulations. Lifesaving equipment for the storage tanker will be required to meet the requirements of the Installations Regulations. Shuttle tankers will carry lifesaving equipment as required by the International Convention of Safety of Life at Sea.

3.6.7 FIREFIGHTING EQUIPMENT

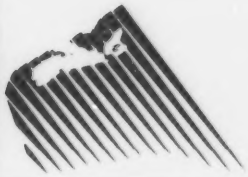
The firefighting equipment proposed is satisfactory to the Board for all installations. Since the deluge water supply for the Panuke platform is supplied from the process water injection system, the Applicant must ensure that this supply remains active in the event of a fire on the Panuke Platform. The Board notes that support vessels suitable for the Project are available with firefighting capability. The Board recommends that the Applicant give careful consideration to acquiring vessels with firefighting capability to support the installations.

3.6.8 POWER GENERATION AND ELECTRICAL SYSTEM

The Applicant proposes to make use of existing rig generation capacity and emergency generation system to provide power for the installation. This is satisfactory to the Board, as long as it is shown that the generation capacity is sufficient to supply the expected load.

The Applicant does not indicate the equipment to be supplied by the emergency generator, or details on any battery backups for emergency systems. These will have to meet the requirements of the Installations Regulations.

Existing rig power generation is diesel powered. As indicated in prior sections, the Board would prefer to see produced natural gas used as a fuel source to provide as much of the project energy requirements as possible. Diesel generation capacity will be necessary during the winter shut in when produced gas is not available and dual diesel/natural gas fuel is not possible on the existing generators. However, the Board requires that natural gas fired generation be added to the facility for use during the production season.



EXPORT SYSTEM 3.7

The concept of a pipeline to carry oil over the seabed from a fixed production facility to a normally moored large tanker serving as a floating storage unit which offloads to a shuttle tanker which delivers the product to markets, is a well established and proven practice. There are many examples of similar systems, some of which have been in operation for many years. Accordingly, the Board has not been asked to evaluate an untried or unproven concept. It has given very careful and detailed consideration to the specific elements and the proposed procedures of a system whose feasibility has been proven in many other parts of the world.

TANKER MOORING STUDY 3.7.1

The Applicant retained consultants who carried out detailed studies of the feasibility of the tandem passive mooring of the two tankers forming part of the Export System at the Cohasset site. Specifically, the study concluded that:

- the mooring threshold for both vessels is a significant wave height (SWH) of 2.5 m.

- the storage tanker (up to 200,000 DWT) and shuttle tanker (up to 80,000 DWT) can safely remain tandem moored to the CALM buoy in sea states up to SWH's of 3.5 m. (equivalent to hawser loads of 280 tonnes on the twin hawsers of the storage tanker mooring).

- the cast off threshold for the storage tanker is a SWH of 4.5 m. (280 tonnes hawser loads).

- the cast off threshold for the shuttle tanker will be determined from more precise modelling once the actual specifications and configurations of both vessels are known.

- the total maximum allowable storage tanker hawser load is 280 tonnes, with a maximum of 200 tonnes on either one of the vessels two hawsers.

- the total maximum acceptable (shut-in production) bow hawser load on the storage tanker is 200 tonnes.

The Board has considered this study, and reviewed it with the Applicant and its consultants. The above noted preliminary minimum mooring and operating criteria have been established, based upon the consultants report. More detailed studies, to be undertaken once the vessels have been selected, may result in changes to these criteria.

3.7.1 CON'T

Condition 12:

There shall be a minimum of 2200 meters, or three times the tandem passive mooring length, whichever is greater, clear distance between the CALM buoy and the nearest platform associated with the production installation. There shall be no mooring of either the storage or shuttle tanker when either vessel would be required to enter that sector of the weathervaning circle defined by an angle of 22.5° on either side of a line drawn between the production installation and the CALM buoy. Unmooring of either tanker when the vessel is lying in this sector shall proceed only when required by environmental conditions and only if the tanker proposing to unmoor is assisted by a vessel with tug capability.

The Applicant has indicated that the export flowline from the production facility to the CALM buoy will be located to the southwest of a straight line drawn between the production installation and the CALM buoy to facilitate emergency anchoring of the tanker when departing upwind of the production installations.

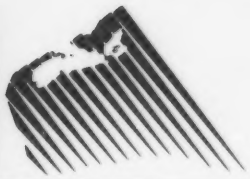
3.7.2 TANKER OPERATIONS

The operations of the Export System are to be undertaken generally in accordance with the requirements of:

- Canadian Coast Guard's TERMPOL CODE TP 743, "A Code of Recommended Standards for the Safety and Prevention of Pollution for Marine Transportation Systems and Related Assessment Procedures".

- "The International Safety Guide for Oil Tankers and Terminals", "The Ship to Ship Transfer Guide" and "Single Point Moorings - Marine and Operations Guide", being publications of the Oil Companies International Marine Forum, ("OCIMF"), an association of oil companies which, in consultation with the International Maritime Organization ("IMO") and other Government bodies, publishes guidelines on the shipment and terminalling of crude oil and oil products.

The Applicant has established preliminary Offshore Tanker Loading Procedures which have been prepared in accordance with the recommendations of the above noted publications. These procedures have been reviewed in detail by the Board and by independent consultants retained by the Board. Approval of a large number of details relating to both tankers and their proposed operations must await the selection of the specific vessels by the Applicant.



3.7.2 CON'T

Condition 13:

Prior to issuance of a Production Operations Authorization, the Applicant shall establish procedures acceptable to the Board to effectively preclude the operations of tankers under its control from the tanker exclusion zone. Tanker movements to and from the Cohasset/ Panuke Site normally shall be via the designated approach channel. The tanker exclusion zone boundaries shall be set so as to adequately protect the area known as "The Gully."

Condition 14:

Both tankers shall be fitted with segregated ballast tanks, protectively located, as required by Marpol '78, Annex 1.

Condition 15:

Both tankers shall be fitted with appropriate means to ensure station keeping in periods of dead calm and to reduce mooring loads during periods of severe weather conditions.

The tanks are to be protectively located. The vessels should be constructed so as to provide protection of the cargo from collision (side) in preference to grounding (bottom). The Board will require that there be a minimum of two (2) watch-keeping officers with SPM experience on board each vessel during unassisted mooring operations.

3.8 DEVELOPMENT DRILLING AND COMPLETIONS

The Board is generally satisfied with the proposal presented in the Development Plan, but it should be noted that additional detail on several items will be required when the application for Drilling Program Authorization is made and the individual wells are authorized for drilling, completion and workovers.

3.8.1. CASING/WELLHEAD DESIGN

The casing is designed to meet all requirements for a normally pressured reservoir to the true vertical depth of 2350 m. The casing program has been modified to eliminate one casing size and yet still reach total depth with the required hole size for completion. As the reservoir pressures are known this casing design is acceptable to the Board.

The wellheads and casing have been proposed to withstand a maximum of 20.7 MPa surface pressure which is adequate as the reservoir pressures are indicated to be normal.

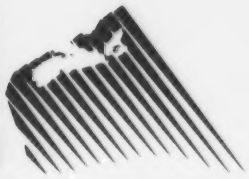
3.8.2 DRILLING FLUIDS/EFFLUENT TREATING

Water based drilling fluids are being proposed for all wells which should prove satisfactory as all the exploratory wells but one were done with water base mud. Low toxicity oil based muds are also being evaluated by the Applicant, but should not be required. In the event a spotting fluid is required, the Applicant proposes and the Board agrees to their using low toxic oil base mud as opposed to diesel which is normally used.

It is proposed that all water based mud and cuttings will be discharged overboard. This should cause no environmental concerns. Details of the additives used in formulating the water-base fluid, however, will require Board approval as part of the Drilling Program Authorization. In the event low-toxicity oil base mud is proposed the Board will perform a detailed review and insure that all regulations and guidelines relating to the discharge of contaminated cuttings and use of base oil are complied with.

Condition 16:

The Applicant shall use water based drilling muds for all normal operations. Where circumstances require the addition of oil to the water based drilling fluid, the Applicant shall use only products approved by the Board as having low toxicity ratings.
Oil-based muds shall be used in special circumstances only and shall contain only materials approved by the Board as having low toxicity ratings.



CEMENTING PROGRAM 3.8.3

The conductor casing is planned to be driven so that cement will not be required. The surface casing will be cemented back to surface and the production string will be cemented back into the surface casing.

This should prevent any communication of formation fluids, decrease corrosion action from the formations, and minimize any chance of leakage due to channeling. The Board is satisfied with the Applicant's approach.

DIRECTIONAL DRILLING/DEVIATION CONTROL 3.8.4

Nine of the eleven proposed wells for Cohasset and Panuke will be drilled directionality. Angles up to 53° will be reached.

The Board is satisfied with the Applicant's plans to use computer planning/monitoring and MWD surveys during drilling of the wells. However, details such as error models, survey checks, and monitoring plans to ensure accurate placement and to prevent collision will be required by the Board prior to final drilling approval being given.

WELL CONTROL/SAFETY 3.8.5

The Board is satisfied that the Applicant's plans for well control and well monitoring will enable the development wells to be drilled safely. The minimum rating of the blow out preventer ("BOP") and well control equipment to be used is 34.5 MPa, which exceeds the wellhead design of 20.7 MPa. The mud logging unit will be fully utilized after the surface casing has been set which will monitor all potentially dangerous parameters. Personnel on board will be required to have training in well control as specified by the Board. A plan will be submitted by the Applicant to the Board for approval regarding procedures fo[illegible]multaneous drilling and/or workovers and production. A philosophy of a minimum of two barriers against any pressure channels was proposed by the Applicant and is acceptable to the Board.

COMPLETION PROCEDURES/ARTIFICIAL LIFT 3.8.6

The Applicant has proposed that at Panuke there will be commingled production from the three producing wells and injection will be into more than one sand. Although the commingled production has not been approved, the Board agrees with the Applicant's approach that completions should be kept simple in particular on the not normally manned PanukePlatform. Room will be provided between zones so that they can be isolated mechanically inside the casing or the perforations can be cement squeezed off and selectively perforated should water breakthrough become a problem. The initial installation of artificial lift is still being evaluated but all wells will be designed such that it can be provided in the future.

The Cohasset sands are more variable and all production wells are planned to be equipped with electrical submersible pumps ("ESP's") at the time of initial completion. Also through the case of an inner tubing string and packers it is proposed that as many as three zones can be separated. The Board is satisfied with this approach, but will review each completion in relation to the overall production strategy when submitted by the Applicant, prior to granting authority to complete each well.

3.9 OPERATIONS AND MAINTENANCE

3.9.1 PREVENTATIVE MAINTENANCE

The Applicant has not included specific preventative maintenance programs in the Development Plan, as these will depend on final equipment selection. However, the Applicant's policy of 24 hour supervision of operations from the Cohasset location with remote monitoring of the Panuke platform through instrumentation is acceptable to the Board. The Board is satisfied that proposals for equipment inspection, vibration monitoring and scheduled turnarounds during winter shut-ins will maintain the facilities in safe working order.

3.9.2. WINTERIZATION

The Applicant states that winterization requirements for short term winter production periods will be minimal, and that it will prevent freezing temperatures in the area where production equipment is located on the rig. The Board agrees that the production equipment and instrumentation systems described should be capable of successful operation under anticipated winter conditions. The Applicant must ensure that any areas susceptible to freezing, in particular fuel and water lines, are adequately protected. The Applicant defines the winter season as the months of November through March.

Condition 17:

No winter production operations shall be conducted in the first year of operation. Any winter production operations for subsequent years are subject to Board approval.

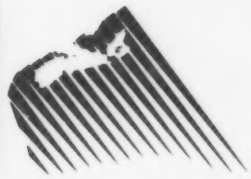
3.9.3. SUPPLY BASE, SUPPORT AND CONSTRUCTION OPERATIONS

No details were provided by the Applicant on the specific operation of supply bases or support vessels. The supply base will be a typical service operation conducted from an existing port facility and presents no unusual concerns. Standby vessels used on the project will be subject to the requirements of Transport Canada's Standards Respecting Standby Vessels, TP 7920E.

It is anticipated that some of the vessels used during construction and operation of the project will be foreign flagged, and will not be required to enter a Canadian port. To ensure that these vessels are suitable, the Board will require these vessels to meet certain standards.

Condition 18:

All foreign flag vessels used to support construction, installation, drilling or production activities shall obtain a Non-Canadian Ships Safety Order prior to undertaking project related activities.



SAFETY PLAN

3.10

The Safety Plan submitted by the Applicant for the Cohasset/Panuke Development Project identifies the major items of concern required for an acceptable safety plan. The Applicant is committed to meet or exceed the requirements of all relevant legislation and regulations in the design and operation of the project. All contractors on the project will also be required to comply with these standards.

A Safety Program will be developed and implemented by a full-time Safety Coordinator. When various contracts are finalized a series of safe job procedures will be prepared for this program. The Board will ensure that these procedures are in compliance with the regulations and all applicable Provincial Legislation.

The Applicant intends to develop a Loss Control Program in order to eliminate or control hazardous situations. Both equipment and procedures will be analyzed to identity potential hazards. The active involvement of work place Health and Safety Committees will contribute towards the identification of these hazards. Copies of the minutes of all Health and Safety Committee meetings will be submitted to the Board in a timely fashion. This will allow the Board to monitor Applicant's follow-up action to items identified at these meetings.

Regular emergency drills will be conducted for the following situations:

- Evacuation and Abandonment;
- Fire Fighting;
- Stability Control;
- Man Overboard;
- H2S Release, and;
- Well Control.

These drills will be conducted on a weekly or fortnightly basis depending on regulatory requirements and operational considerations. The Applicant will also be required to conduct an annual Oil Spill Countermeasures Exercise. This will be a major exercise involving all elements of the East Coast Spill Response Organization.

In addition to the above mentioned drills, the Board expects to initiate a Communications Exercise designed to assess the Applicant's response to an emergency situation. This would involve the unannounced presentation of an emergency scenario to the OIM. The OIM, in turn, would react in accordance with the appropriate emergency response plan and mobilize the necessary personnel and equipment. All actions taken must be documented and the Applicant will be required to critique their response.

At this time, a manual outlining the specific training and qualifications required by offshore personnel is being prepared by industry and government representatives. The Board is actively involved in this process and the Applicant intends to adopt the standards established in this manual.

In summation, the Applicant has prepared a preliminary Safety Plan which complies with the intent of regulatory requirements. Several areas such as job procedures and loss control programs cannot be addressed until contracts are finalized and equipment is chosen. The Board will ensure these areas are addressed by the Applicant in the comprehensive Safety Plan required to be approved under the regulations, prior to issuance of the Production Operations Authorization.

3.11 COSTS AND ECONOMICS

3.11.1 CAPITAL COSTS

The proposed capital cost for the project is $160 million (1989 dollars), to be spent over the first five years of the project. This figure is approximately 15% higher than the $139.2 million capital cost shown in the cost backup. Land acquisition costs have been dropped from the estimate. It would appear that most items have had additional contingency allowances added, since the basic assumptions used in the original cost backup have not changed. The Board agrees with the added contingency, considering the conceptual nature of the engineering studies used to develop the cost estimates.

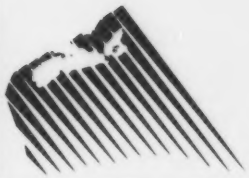
3.11.2 OPERATING COSTS

Current operating cost is estimated to be $405 million (1989 dollars) for the life of the project. This is up $132 million from $273 million in the cost data backup. Costs for management and supervision, workovers and abandonment have remained approximately the same. Annual costs for the jack-up unit and storage tanker/offloading system have also remained similar, but the project has been extended into 1997, which accounts for $55 million of the increase. Annual costs for production operations have been increased substantially accounting for $75 million of the increase in costs. Other items have had small amounts of additional contingency added in, accounting for the $2 million remaining.

The extension of the operation by an additional year into 1997 accounts for more than half the operating cost increase from the backup data to current estimates. The Board feels this is appropriate as this reflects the construction and depletion schedule proposed in the development plan. The increased cost of operating production equipment (including jackets and subsea flowlines) and additional contingencies in other items accounts for the balance of the operating cost increases. The Board feels these increases are reasonable considering the minimal historic cost data available for operation of a similar nature, and the market variability of leased equipment costs.

3.11.3 ECONOMICS

The initial development plan application did not contain any economic analysis. Base case economics were provided at the Board's request along with sensitivities to a numbers of factors in order to allow an assessment of the economic strength of the project. Based on this information, the Board is satisfied that the project, as proposed, has sufficiently robust economics to offset any adverse problems which might arise.



ABANDONMENT

3.12

The plans for abandonment of the installation at the end of economic production are satisfactory to the Board. Wells will be abandoned below the seabed using well established procedures. Leased equipment, including the jack-up rig, CALM Buoy, storage tanker and shuttle tankers will be released and removed completely from the site. Subsea flowlines will be retrieved from the seabed and removed to shore. Wellhead jackets will be removed by severing the piles holding them to the floor. Experience in these procedures is being established through platform abandonments in the Gulf of Mexico. The applicant did not state if the wellhead jackets would be brought to shore for scrap or disposed of at sea. Regulations require that the Applicant submit specific plans for abandonment of each part of the installation prior to conducting these operations.

The Board feels that the Applicant's estimate of abandonment costs is reasonable. To ensure that funds are available for abandonment, the Board requires the Applicant to establish a plan to satisfy the Board with respect to the Applicant's financial responsibility for abandonment.

Condition 19:

Prior to production start up, the Applicant shall establish a plan, suitable to the Board to ensure that sufficient funds are provided for proper abandonment of the installation after production ceases.

APPENDIX A

GLOSSARY

Aquifer
A porous rock that is water bearing.

Board, the
The Canada-Nova Scotia Offshore Petroleum Board

Certifying Authorities
Bodies licensed by the Board to conduct examination of designs, plans and facilities and to issue Certificates of Fitness.

Certificate of Fitness
A certificate issued by a certifying authority stating that a design, plan or facility complies with the relevant regulations or requirements.

COGLA
Canada Oil and Gas Lands Administration.

Completion
The activities necessary to prepare a well for the production of oil and gas.

Cuttings
Chips and small fragments of rock that are brought to the surface by the drilling mud as it circulates.

Delineation well
Well drilled to determine the extent of a reservoir.

Directional drilling
Intentional deviation of a wellbore from the vertical to reach target areas laterally displaced from the point where the drill bit enters the earth.

Drilling Fluid
Special fluids, either oil or water based, used to cool and lubricate the drill pipe and drill bit.

Drilling Mud
A special mixture of clay, water and chemical additives pumped down the wellbore through the drill pipe and drill bit to cool the rotating bit, lubricate the drill pipe as it turns the rotating bit in the wellbore, carry rock cuttings to the surface, and control downhole pressure. Water base or oil base drilling mud may be used.

DST
Drill stem test. A short test of the productive capacity of a well through drill pipe.

DWT
Deadweight tonnage; the maximum design weight of cargo, crew and effects for a ship.

Effluents
The liquid waste discharges of sewage and industrial processing.

Export line
The oil pipeline from the production platform to the storage tanker.

Fault
In the geological sense, a break in the continuity of rock types.

Flare
To burn off gases not otherwise required.

Flowline
Subsea pipeline connecting satellite wells to a central production platform.

Helideck
A landing platform for helicopters.

Injection
The process of pumping gas or water into an oil-producing reservoir to provide a driving mechanism for increased oil production.

Logging
A systematic recording of data from the driller's log, mud log, electrical well log, or radioactivity log.

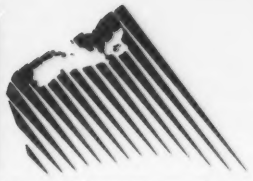
Manifold
A piping arrangement containing the valving to flow into several parts, combine several flows, or re-route a flow to one of several possible destinations.

MWD
Measurement while drilling - a technique to determine the position of the drill bit in a directionally drilled well.

Net pay map
A contour map depicting net thicknesses of hydrocarbon-bearing reservoirs.

Oil-base mud
Drilling mud in which oil is the continuous phase.

Appendix A



OIM
Offshore Installation Manager

100-year return
an event of a magnitude that statistically is predicted not to occur more than once in a 100-year period.

OOIP
Original oil in place.

Petrophysics
Study of reservoir properties from various logging methods.

Porosity
The volume of the pore space expressed as a percent of the total volume of the rock mass.

Produced water
Water associated with oil and gas reservoirs that is produced along with the oil and gas .

Production platform
An offshore structure equipped to produce and process oil and gas.

Production well
A well drilled and completed for the purpose of producing crude oil or natural gas.

Recoverable Reserves
That part of the hydrocarbon volumes in a reservoir that can be economically produced.

Reservoir
A porous, permeable rock formation in which hydrocarbon have accumulated.

Reservoir pressure
The pressure of fluids in a reservoir.

RFT
Repeat Formation Tester. A tool which records reservoir pressures at multiple points in a well.

Sandstone
A compacted sedimentary rock composed of detrital grains of sand size.

Satellite wells
Subsea wells located remove from the production facility and connected to the facility by flowlines.

Scour
An elongated depression or trench in the seabed resulting form the erosive action of currents.

Seismic
Pertaining to, characteristic of, or produced by earthquakes or earth vibration, as seismic disturbances.

Shuttle tanker
A ship which regularly transports oil or other products from a production facility to an unloading facility.

Spud
To start the drilling of a well.

Toxicity
The degree to which a toxin is harmful.

Toxin
Any substance which in sufficient quantity is harmful to biota.

Water-base mud
A drilling mud in which the continuous phase is water.

Wellhead
The equipment installed on the top of the well.

Workover
Operations on a producing well to restore or increase production.

Appendix B

Cohasset/Panuke Environmental and Socio-Economic Public Review Commission

Summary of Conclusions & Recommendations

1. In summary, the Commission believes that, with the stipulations contained in this report, the project can be undertaken without serious environmental impacts and recommends to the Board that the project be permitted to proceed. Specifically, the Commission recommends that:

2. The Board require LASMO to consider the economic and technical feasibility of reinjecting produced water. If reinjection is not feasible, treatment systems capable of achieving effluent levels of less than 25 mg/L should be considered. In no event should the levels of hydrocarbons in produced water be above the regulated limited (40 mg/L on a 30-day average).

3. Procedures for notification and enforcement of the safety exclusion zone are to be worked out between LASMO and the fishing industry, and these procedures be communicated to fishing vessel captains and captains of supply boats. These procedures should be periodically reviewed to ensure that they are being effectively adhered to.

4. LASMO, in consultation with the fishing industry and appropriate government agencies, establish procedures for notifying fishing vessels of all project-related vessel traffic movements and adhere to those procedures throughout the life of the project.

5. The Commission recognizes the need to ensure the continued commitment of on-duty offshore personnel to remain alert to the possibility of stray shipping intruding on the exclusion zone, particularly at night and during adverse weather. The Commission recommends that provision be made for regular review of diversion procedures established in operation guidelines.

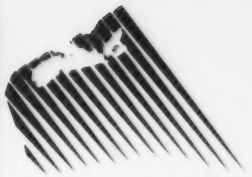
6. The shuttle tanker exclusion zone proposed by LASMO to avoid the area known as "The Gully" be implemented and adhered to; and LASMO, in consultation with the Board and other government agencies, consider how best to ensure compliance with the zone.

7. LAMSO and the fishing industry work together to develop a thorough and mutually acceptable attributable compensation plan prior to commencement of development drilling; the Board should consult with the Department of Fisheries and Oceans prior to approving the plan, and details of the plan should be communicated to fishermen.

8. LASMO's compensation plan clearly set out the conditions under which specific provision will be made for the granting of compensation for pre-emption of fishing activity, tainting and fouling of gear due to condensate spills, or other eventualities resulting from the Project.

9. The Compensation package outline conditions under which provision will be made for losses to fishermen resulting from third parties associated with the Project.

10. While Canada is not yet a signatory to the 1978 Protocol to the International Convention on the Prevention of Pollution from Ships 1973 (MARPOL 73/78), and many Canadian vessels are unable to meet MARPOL standards, the Commission recommends that the Board formally accept LASMO's expressed intention to voluntarily comply with these and other conventions directed to improved tanker safety.



11. The Board establish a monitoring advisory committee to advise it on both compliance and environmental effects monitoring issues. The committee should be given an opportunity to review monitoring plans prior to their approval and implementation and regularly review monitoring results. The committee should include a representative from the fishing industry, as well from DFO, Environment Canada, EMR, and other government agencies with resource or regulatory interests in the Project.

12. The Board seek ways to monitor the day-by-day procedures on the production rig that relate to environmental protection.

13. In approving a contingency plan, prior to granting permission to undertake drilling or production, the Board provide an opportunity for review and comment by relevant government departments including DFO and Environment Canada.

14. The contingency plan include procedures to locate and move a rig capable of drilling a relief well to the site should one be required to counter a blowout.

15. The elements of the Environmental Protection Plan relating to various project activities be approved and in place before approval to proceed with each activity is given.

16. Prior to approval of an Environmental Protection Plan, the Board establish a consultative process to facilitate the incorporation of the concerns of all relevant government departments including DFO, Environment Canada and EMR. Discussions should also be undertaken with fishing industry to establish to mechanism to allow their concerns to be considered before approval of a plan.

17. Prior to approval to undertake production the Board require LASMO to submit a satisfactory operating plan that specifies:

- The environmental limits for oil transfer from the CALM buoy;
- Shuttle/storage tanker oil transfer procedures;
- The alerting procedures to trigger protective actions under adverse weather conditions. These would include procedures to evacuate the rig under extreme conditions.

18. The operating procedures clearly indicate the chain of command and identify decision-making responsibilities under normal, alert and emergency conditions.

19. The Commission believes that the industrial and employment opportunities associated with this project will be good for the economy of the province, and recommends that, from a socio-economic perspective, the proposed project should proceed.

20. Recognizing that for effective overall management as well as for economic reasons, the supply base is likely to be located in the Dartmouth/Halifax area, the Commission notes that this does not prevent LAMSO from making use of some of the facilities in Mulgrave . The Commission therefore recommends that the Board encourage LASMO to make use of facilities in Mulgrave wherever feasible.

21. Every effort be made to finalize Memoranda of Understanding between the Board and the appropriate federal and provincial government agencies at an early date so that the relationships and responsibilities are clearly defined and understood by the various parties involved in the proposed offshore development.